INDUSTRIAL REFRIGERATION

BUYER'S DIRECTORY ISSUE

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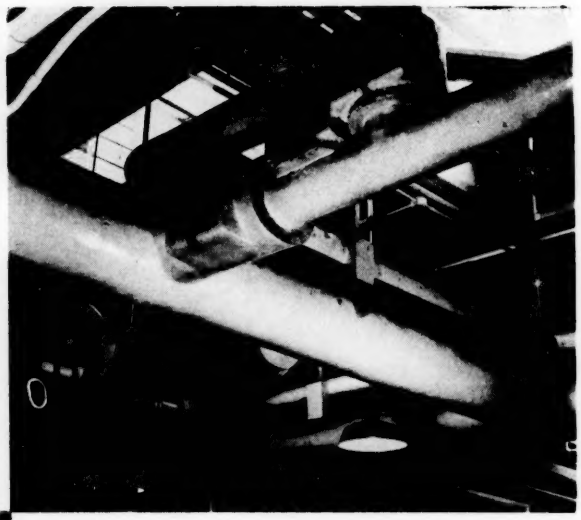
Waterproof · Economical Easy-to-Install

VAPO-WALL

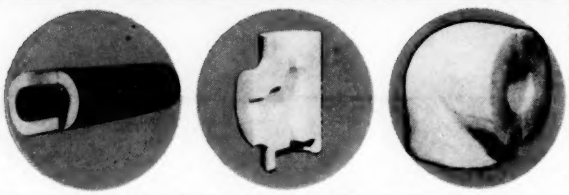
LOW-TEMPERATURE PIPE INSULATION

Maintains its original insulating efficiency... Requires no extra vapor barriers



EASY-TO-CUT

LIGHTWEIGHT



Factory-made coverings for ells, tees, valve fittings, etc., fit perfectly . . . provide positive air and moisture seal. All Vapo-Wall coverings are guaranteed to fit.

VAPO-WALL is made of Styrofoam,® the most nearly-perfect insulating material ever developed.

- ★ permanent 'K' factor of .25
- ★ won't absorb water, swell, soften, freeze or waterlog
- ★ strong . . . compressive strength of 1½ tons per square foot
- ★ odorless . . . and does not absorb odors
- ★ resistant to mold, rot and vermin . . . has no food value
- ★ tough . . . completely unaffected by sudden temperature changes
- ★ effective insulation range of from —400° F to 180° F

® TRADEMARK, DOW CHEMICAL CO.

Service-proven in hundreds of food-processing plants all over the country, Vapo-Wall is the preferred low-temperature insulation for pipes, vessels and fittings. Absolutely moistureproof, permanently heat-resistant, Vapo-Wall gives you more for your insulation dollar, including such economy features as:

- ★ EASE OF HANDLING . . . lightweight . . . can be cut with ordinary tools . . . non-irritating . . . doesn't crack or crumble.
- ★ LARGER PIECES for big jobs . . . eliminates expensive lagging . . . reduces installation time . . . one piece of Vapo-Wall can often do the same job as 8 or more pieces of other types of pipe coverings.
- ★ WET LINE INSTALLATION . . . no need to shut down operations. or make the installation on overtime.
- ★ SIMPLE TO INSTALL even by unskilled personnel . . . for jobs too small to contract, installation can be made by your own maintenance crew.
- ★ CUTS REFRIGERATION COSTS . . . locks in cold, shuts out heat permanently.
- ★ LITTLE OR NO MAINTENANCE REQUIRED . . . assures long, trouble-free service life.

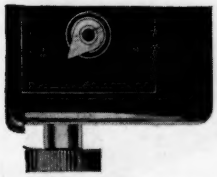
Vapo-Wall is available in all standard sizes of pipe, vessel and fitting covers in extra-light, light, medium and heavy-duty thicknesses. Special sizes and thicknesses fabricated promptly upon request. Write today for complete information.

M M M incorporated

1315 Hutchins • Houston 1, Texas • CApitol 8-2387

ELECTRIC Heating Cable DEFROSTERS

for LOW TEMPERATURE DOORS



1 • Temperature adjustment control.

2 • Adjustable thermostat for range of +85° to +245° F.

3 • Steel electrical outlet box for making connection between heating element and thermostat—inlet for power.

4 • Rabbeted channels into casing.

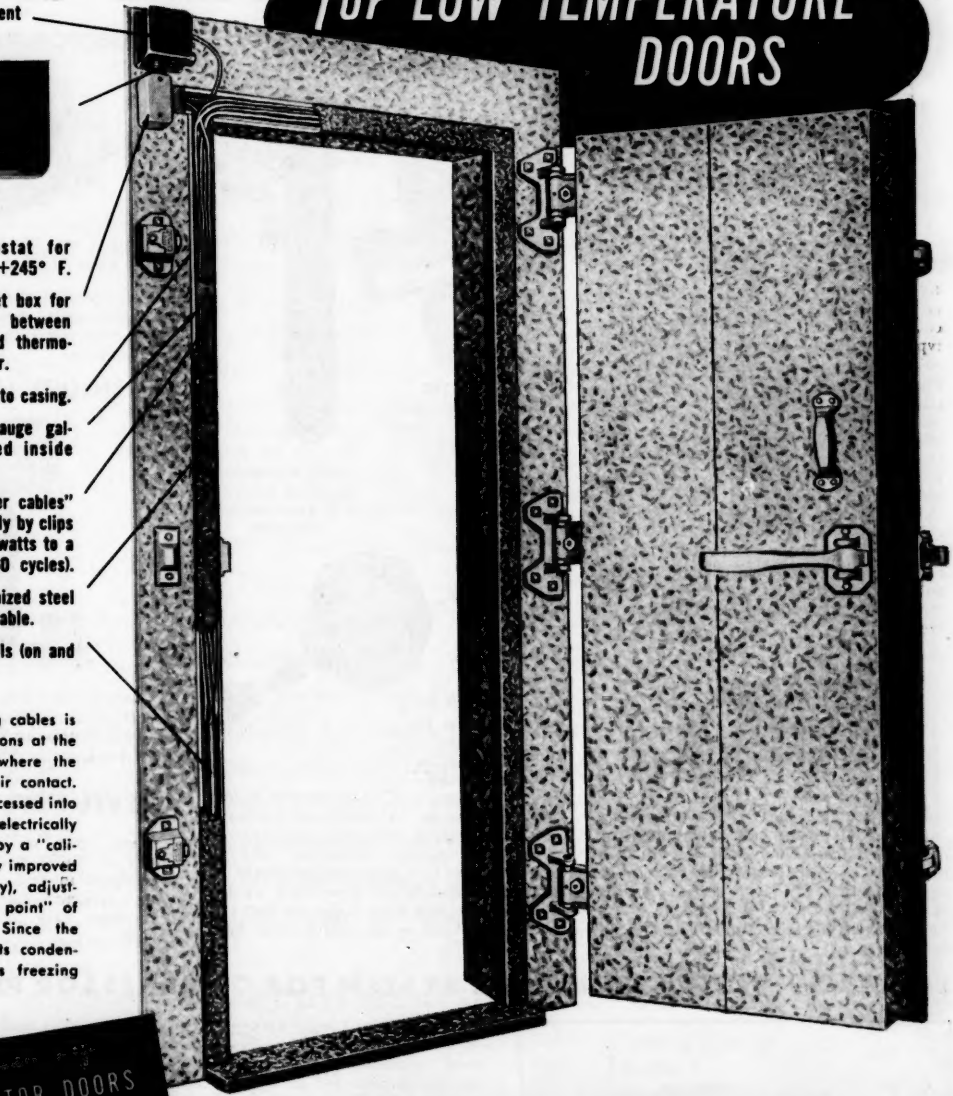
5 • Fireproof No. 26 gauge galvanized metal lined inside channel.

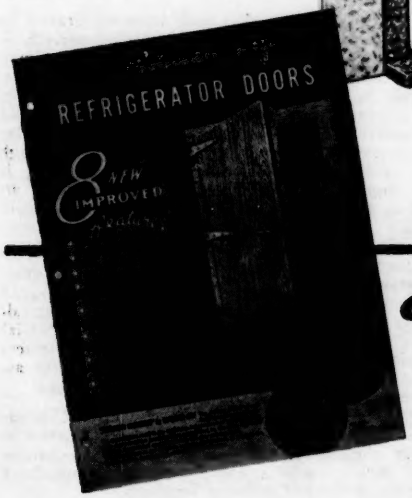
6 • Lead covered "heater cables" (4) held down securely by clips —approximately 20 watts to a foot. (110 volts—60 cycles).

7 • No. 10 gauge galvanized steel cover plates—removable.

8 • Capillary tube controls (on and off) thermostat.

The purpose of heating cables is to prevent icing conditions at the frame and sill areas where the door gaskets make their contact. The cables which are recessed into the frame casing are electrically heated and controlled by a "calibrated thermostat" (new improved feature by Butcher Boy), adjustable above the "dew point" of the air temperature. Since the heat expended prevents condensation it thus prevents freezing conditions.





"Butcher Boy"

QUALITY SINCE 1885

Send

FOR NEW 1956 CATALOG ILLUSTRATING 8 NEW IMPROVED FEATURES

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1000 Butcher Boy Drive • Harvard, Illinois

Gentlemen:
Send me your new 1956 Refrigerator Doors catalog

Name_____

Firm Name_____

Address_____

City_____ State_____

H. A. PHILLIPS & COMPANY

3255 West Carroll Ave., Chicago 24, Ill., U.S.A.

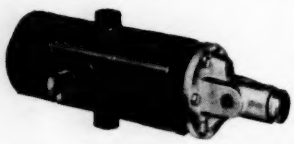
Designers and Engineers Control Systems for Refrigeration and Air Conditioning

FLOAT CONTROLS

PHILLIPS
FLOAT CONTROLS

For shell and tube type coolers, large room coils, various types of tank coils. Modulating valve action insures maximum Btu. transfer at all loads. Float with adjustable level located in chamber outside the evaporator. New Phillips "Level-Eye" with Frost Shield on float chamber shows normal liquid level. Capacities up to 50-tons with ammonia, to 12-tons with Freon.

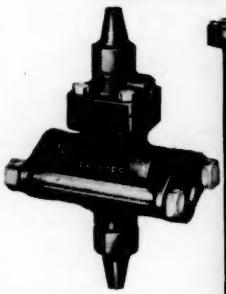
No. 101 Remote Feed Valve with Float Chamber for Ammonia or Freon



No. 301 Remote Feed Valve for Ammonia

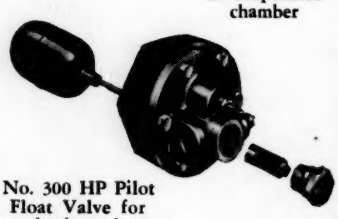
Cartridge-type for easy replacement of needle and seat. Float chamber which is connected to evaporator with balance or equalizing lines is equipped with Phillips "Level-Eye" with Frost Shield to show liquid level. Capacity from 2 to 50-tons ammonia.

PILOT OPERATED FEED VALVES



No. 701 Pilot Operated Ammonia Feed Valve

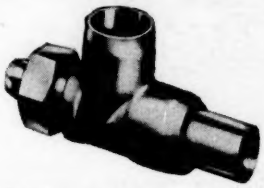
No. 100 VP Pilot Float Valve for mounting external of evaporator chamber



No. 300 HP Pilot Float Valve for horizontal installation in surge drum

Pilot operation of valve permits higher capacities to be handled with modulating-type control. Can be operated by float valve, thermal expansion valve or solenoid. For best action, pilot should be a natural modulating type, such as the Phillips No. 300 Pilot Valve or No. 100 VP Pilot Valve with welded steel float chamber.

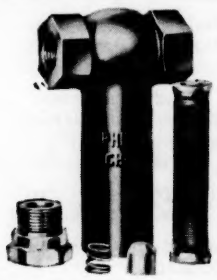
INJECTOR-RECIRCULATORS



No. 2100 SL Refrigerant Injector

Jet energy pumps liquid refrigerant through coils, giving best heat transfer. Available for Freon refrigerants as well as ammonia.

LIQUID LINE FILTERS

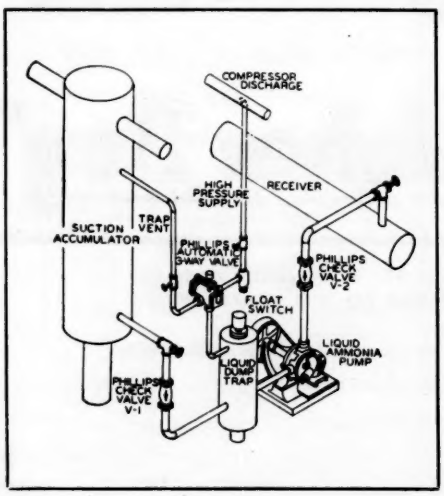


Assures long life of valve parts. Especially recommended for use with float valves. Filters available with 200 stainless steel mesh. Straight or angle type.

"LEVEL-EYE"

Lets you "see" level of liquid refrigerants in pressure systems. Inexpensive, easy to install.

LIQUID REFRIGERANT RETURN SYSTEM FOR COMPRESSOR PROTECTION



The Phillips Liquid Return System is an arrangement of a liquid trap with automatic controls and connecting piping for protecting compressors from slugs of liquid refrigerants. It automatically returns "slop-over" directly to the receiver without regenerating and re-condensing the liquid. As shown in the drawing, the system takes liquid ammonia which has collected in the accumulator, drains it through an outlet valve and check valve (V-1) into a liquid trap. Drainage occurs when the trap is at a low pressure. The trap is vented to the accumulator through a three-way valve and vent line. As the trap fills, a float switch is activated, energizing a three-way valve. This valve closes the vent line and connects the compressor discharge to the trap. Pressure builds up in the trap and closes check valve V-1. Pressure in the trap then reaches the same pressure as the receiver, opening check valve V-2 and allowing gravity to carry the liquid to the receiver. If gravity flow is not possible, a liquid ammonia pump is used. High pressure at the pump inlet prevents flashing the liquid. When the liquid trap is empty, the three-way valve is de-energized, closing the high pressure line to the trap. The trap is again vented to the accumulator, allowing liquid to drain once again into the trap.

This arrangement is highly efficient since only one pound of compression gas is required to move 25 pounds of liquid. There is practically no loss of refrigeration potential to the recovered liquid. The system also permits oil flushed into the accumulator to be easily drained.

A number of "packaged" variations of this system in capacities to 1000-tons are available to handle all arrangements of accumulator and receiver locations.

STAND-OUT

Temperature-Tolerance Study of Frozen Foods

FOOD scientists were greatly interested in the research conference held in Albany, Calif., July 30 to August 1 on the time-temperature-tolerance study of frozen foods. This conference was reviewed in the September INDUSTRIAL REFRIGERATION. Among the noteworthy comments was one appearing in the August 15 Information Bulletin of the Refrigeration Research Foundation. This comment follows:

There is much to be reported from the time-temperature-tolerance study on frozen foods at WURB in addition to the technical facts.

First, industrial groups concerned with frozen foods are intensely interested in it. Probably no other single project has ever deserved nor been accorded so much interest. At the meeting, July 30 to Aug. 2. representatives were present from the National Association of Frozen Food Packers, the Western Frozen Food Processors Association, the Northwest Canners and Freezers Association, NARW, TRRF, National Wholesale Frozen Food Distributors, Institute of American Poultry Industries, National Turkey Association California Farm Bureau, American Trucking Association, Railroad-owned Refrigerator Car Committee, PFE. Pac-Amer Steamship Association, National Association of Retail Grocers, National Association of Food Chains, Can Manufacturers Institute, ASRE, U. S. Food and Drug Administration, Bureau of Food and Drug Inspection of California, the QM Corps and several USDA and State Experimental Station groups were represented also.

A number of compaines in the frozen food industries have aided the project by sending representatives to meetings and supplying advice and samples. Certainly, it has rarely happened that so many have taken so much interest in a single research undertaking. TRRF is, of course, pleased to have had a significant part, from its very beginning, in an advisory capacity and financially, in this comprehensive project. TRRF provided much of the industrial stimulus which helped this enterprise to be undertaken.

Second, the results of all of this costly work will have little value if the very large educational program it entails is not undertaken with

(Continued on page 85)

Industrial Refrigeration

formerly ICE AND REFRIGERATION
Now in its 65th Year of Publication

J. F. NICKERSON, FOUNDER

Vol. 131 October, 1956 Number 4

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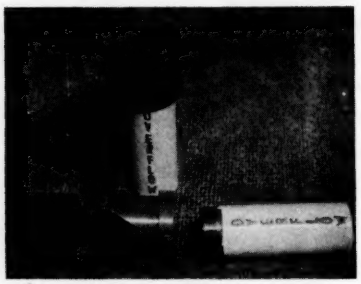
What's New

MACHINERY
APPLIANCES • PROCESSES

Bleed-Off Control For Cooling Towers

THE DEADY V-Notch Weir, a device for adjustment and control of bleed-off in cooling towers and evaporative condensers, has been developed by the Deady Chemical Co., Kansas City, Kansas. The V-Notch Weir provides variable bleed-off for control of concentrations and also acts as a skimmer for removal of suspended solids and surface trash. Company states scale deposition and corrosion can definitely be reduced and controlled by controlling the concentration and using properly formulated chemical treatment.



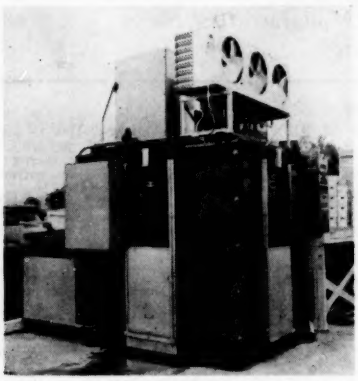
The New Deady V-Notch Weir

New Ice Packaged Unit Delivers Flake Ice

THE Do-it-yourself trend has captivated the imagination of companies seeking lowered costs of ice. No work is entailed except that of pushing a control button or setting an automatic clock. Ice making, in units that range from 1,000 lbs. to 20,000 lbs. daily, is now accomplished thru a "packaged" ice plant that delivers ice in flaked form.

Foremost-Golden State installed such a "packaged" flaked ice plant at Ventura, California, which was engineered and assembled by Moore & Hanks, refrigeration engineers and manufacturers of El Monte. The plant consists of an automatic ice making unit, air-cooled condensor, galvanized steel-lined redwood storage bin, with counterbalanced sliding steel access doors, and freon compressor unit in a weather-proof housing. The plant is skid mounted so that it may be easily moved from one location to another. All electrical circuits and controls are factory wired, ready to run.

M & H packaged ice plants can be leased. Under lease arrangement, M & H guarantees a fixed cost of ice that may be 40 percent less than the customer might currently be paying for ice, delivered at the site, and insures the customer against product loss that might occur through power failures or other causes.



This ice packaged unit makes and delivers flake ice

Tie It In Knots? Why Not?

THAT'S how Rubatex Division, Bedford, Virginia demonstrates unusual flexibility of its new Closed Cellular Rubber Tubing. Developed specially to stop condensation on copper formed cold lines, it is a "slip-on" tubing insulation which readily bends without cutting or fitting and fits snugly to any contour of pipes.

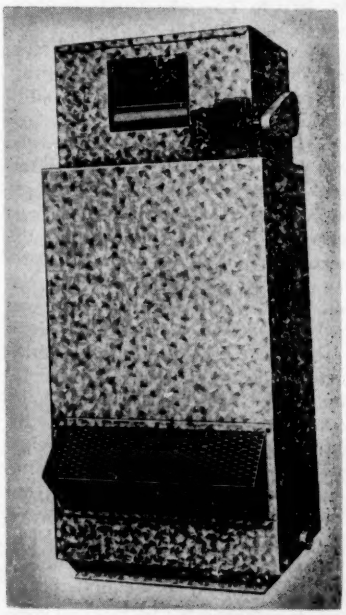
Sample of cellular rubber tubing being tied in a knot.

For application on cold carriers already installed, can be slit lengthwise, snapped around piping and sealed with an adhesive specially manufactured for this purpose.

Has unique nitrogen-filled closed cellular structure which repels water and moisture, eliminating any necessity of additional vapor barrier. Fire-safe, the Rubatex Tubing has good thermal insulation properties — a low K-factor of .28 at 75 F. which remains constant as Rubatex will not deteriorate in service. Manufactured with minimum inside diameter of ⅜ inch and is produced in any lengths up to 250 feet.

New Dover Cooling Tower Answers Space Problem

THE availability of a new packaged cooling tower — the series "V" vertical induced draft tower is announced by The Dover Manufacturing Company, Independence, Mo. The most significant new feature is the fact that the Series "V" Tower is designed to solve the limited space problem that is encountered in many cooling tower installations.



Series "V" Vertical Induced Draft Cooling Tower

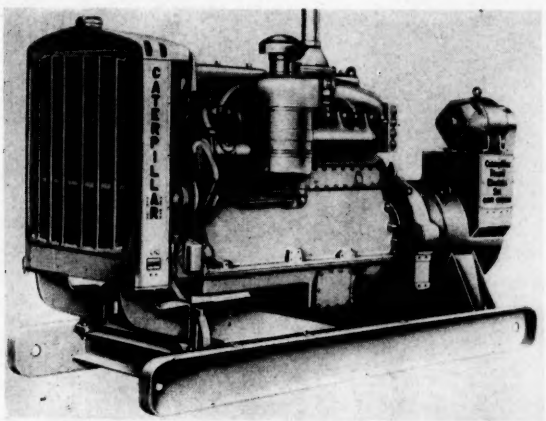
This tower, because of its vertical rather than customary horizontal design, requires a minimum of floor space for installation. A centrifugal blower is used to provide the air flow within the tower and piping and duct work to the tower are kept to a bare minimum. The tower may be used for both interior and exterior installations and, because both air intake and outlet are located on the same side of the tower, the unit may be placed flush against a wall.

When used inside, the tower can be located adjacent to the compressor thus eliminating the need for additional piping. Inside location is practical because of the super-quiet operation of the tower. In fact, it may be placed in the same room with workers without any noise problem. The centrifugal blower eliminates the usual fan noise.

Other features of the Dover series "V" tower are: counter-flow design for more efficient cooling; an unique water distribution system that produces a "square solid" spray; "Z" shaped fill and Dover's exclusive hot-dip galvanizing after fabrication."

Caterpillar Announces New Self Regulated Diesel Electric Set

A NEW 100 KW self-regulated diesel electric set has been added to the expanding line of Caterpillar-built power generating equipment, according to a recent announcement by Caterpillar Tractor Co. Known as the Cat D342 Electric Set, the new unit uses one of the highly compact new Caterpillar self-regulated generators to make available the principal advantages of previous self-regulated and externally-regulated generators in one package.



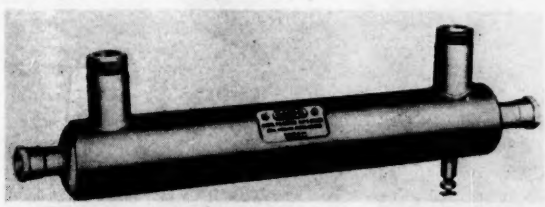
The new 100 KW Cat D342 electric set.

In order to assure maximum efficiency, the new generator has been designed and built specifically to match the Cat D342 Diesel Engine. It features extremely close voltage regulation and in most cases is capable of filling the needs of applications now served by externally-regulated units. Voltage droop and terminal voltage can be adjusted on the new generator to meet the needs of special installations. After adjustment, the controls are locked and no further adjustments are required.

The new electric set's compact size and ease of connection help to simplify installation. No elaborate switchboards or external controls are required. It is easily paralleled with other generators. Sufficient electrical capacity has been built into the new generator to give it the ability to handle the surge of heavy loads without affecting existing loads. Life of the generator is expected to match that of the D342 engine which powers it.

New Oil Coolers

A LINE of 'WIO' Oil Coolers has been introduced by Heat-X Inc., Brewster, N. Y., which have application on all types of diesel and gasoline engines, hydraulic equipment, air compressors, machine shop coolant systems and wherever oil must be efficiently cooled in a compact unit.



New WIO Oil Cooler introduced by Heat-X Inc.

The new oil coolers feature Inner-Fin construction, a patented Heat-X design which permits more cooling in less space. Company officials point out that for any required capacity, this exclusive design means that a 'WIO' Oil Cooler is the most compact unit made. Smaller size also means lower operating cost. The coolers are of completely non-ferrous construction, with brass shell and copper tubes. Units are available for operating pressures up to 250 PSI and operating temperatures to 300 F.

An 8 page descriptive bulletin is available from the manufacturer.

When it's a question of new refrigeration coils, it's no time to speculate on dependability or to compromise on quality. And where it's a question of assuring efficient, uninterrupted operation and low maintenance throughout the years—

NATIONAL
REFRIGERATION
COILS

offer you the benefits of over 70 years' specialization in the pipe-bending field: experienced engineering and exact production, with smooth bends, perfect welds, and accurate measurements.

Whenever you need coils, write for our free tracing-chart which shows standard dimensions ready to fill in. It will simplify your specifications—whether for zig-zag or nested box or conical or round-flat or reducing coils.

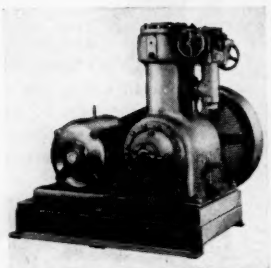
NATIONAL PIPE BENDING COMPANY
162 RIVER STREET • NEW HAVEN, CONN.

Established 1883

IN REFRIGERATION *it Pays to Know* HOWE

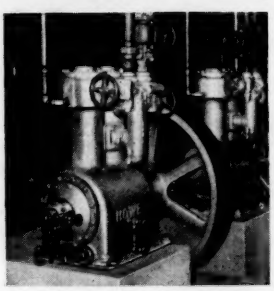
COOL IT —

with one or more of Howe's complete line of modern space-saving automatic ammonia compressors. Sizes — 2 to 150-ton capacity. Built for maximum service with minimum cost.



FREEZE IT —

with Howe Booster Compressors. Food freezing techniques to meet today's rigid requirements. Can be engineered and built to your local plant conditions with equipment manufactured by Howe.



HOLD IT —

A complete line of high efficiency unit coolers, polar circle coils, fin type coils — designed to handle any size of storage cooler or storage freezer. For preserving fresh and frozen foods.

Write for literature

CONTRACTOR-DISTRIBUTORS — Several exclusive territories still open. Your inquiry invited.

HOWE ICE MACHINE CO.

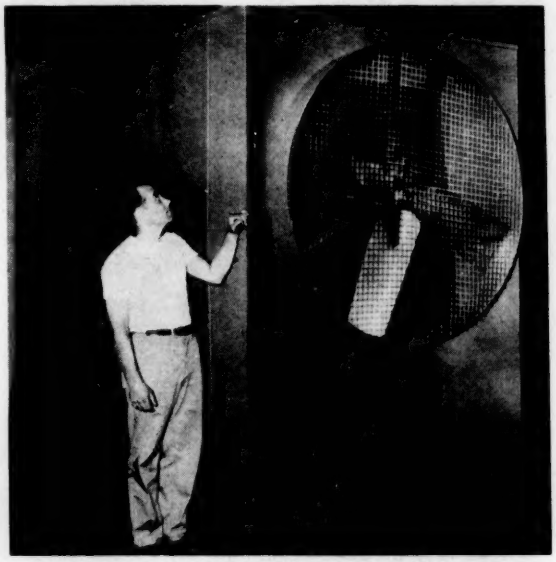
Since 1912, manufacturers of ammonia compressors, condensers, coolers, fin coils, locker freezing units, air conditioning (cooling) equipment.

2829 MONTROSE AVE. • CHICAGO 12, ILLINOIS

Distributors in Pincipal Cities. Cable Address HIMCO Chicago

New 75-Ton Cooling Tower

THE size range of Halstead & Mitchell cooling towers has been extended to include 75-ton units, it is announced by Horace I. Schmidt, general sales manager of this Pittsburgh, Pa. firm. The wetted deck surface wood is pressure creosoted and is covered by a 20-year guarantee against attack by rotting or

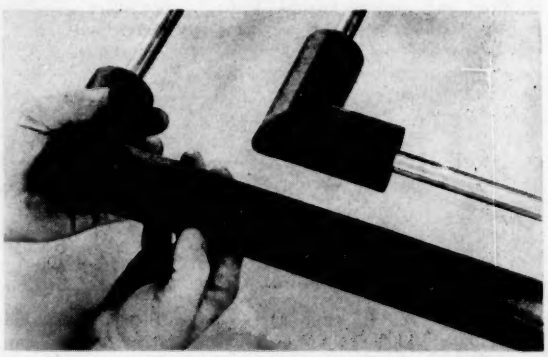


New Halstead & Mitchell 75-ton Cooling tower.

fungus growth. The 75-ton cooling tower makes use of a 4-blade, slow speed, zinc-plated and chromate-dipped fan which provides quiet operation. Fan shifts are made of stainless steel. Three protections are used on the steel cabinet to eliminate rust. Hydraulically applied to force the paint into every opening, the Vinsynite, Vinyl Zinc and chlorinated rubber paints provide a completely bonded coating.

Film Shows New Pipe Insulation

AN eleven minute sound-slide film about a pipe insulation that is claimed to save up to 50 per cent in installation time over conventional insulations has been released by the Insulation Division of the Armstrong Cork Company. The film is a discussion of Armaflex, a new, flexible, foamed plastic pipe covering. Designed originally for residential air-conditioning and dual-temperature lines, the new insulation has been found to be practical



One of the scenes from film showing installation of Armaflex foamed plastic pipe covering.

in preventing condensation on any residential-commercial copper tubing or iron pipe operating in a temperature range of 32-200 F. Because of its flexibility, Armaflex can be applied to new or existing pipes with a minimum of fitting cover fabrication and only sundry material, saving about half the labor.

When long, low-cost service is of primary importance, use this cold room insulation

When you build a temporary type cold room, it's logical to use materials chosen to do a temporary type job. But for a building planned to last a long time, good judgment demands more permanent construction. The insulation that goes with that kind of construction is Armstrong Corkboard. Corkboard has a service record unequalled in the low-temperature insulation field. When properly installed, it lasts for many years. Hundreds of jobs 20, 30, and even 40 years old are still operating today. That's because Corkboard's natural cellular composition keeps moisture out . . . and because a tight, efficient installation job can be done with this highly workable product. Long, trouble-free service means low operating costs . . . more value for insulation money spent.

Corkboard is one of the many quality products in the full line of Armstrong Industrial Insulations. Armstrong also offers you a complete contracting service geared to install these materials economically and efficiently.

For an interesting booklet on Corkboard's long life, and for information on other Armstrong insulations, check the coupon below.

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INDUSTRIAL INSULATIONS

☐ Let's Look at the Record (tells why cork lasts so long)

☐ Armstrong Armaglas* Insulations for Low-Temperature Rooms

☐ Armstrong Insulcolor®, Insulation Finish in Eight Colors

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Petro Unions for ease of replacement. In the event of an emergency, the 3-way valve can be opened half way allowing both relief valves to function. ½" size certified by N.B. and A.S.M.E.

COMPARE THESE CAPACITY RATINGS

½" size Capacity Lbs. / Min. Air	Set Popping Pressure of Valve Lbs.
6.9	50
9.6	75
12.3	100
15.0	125
17.6	150
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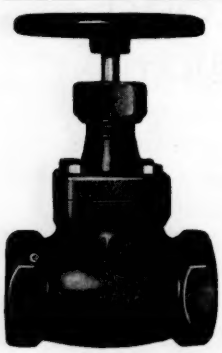
25.4	225
27.9	250
30.5	275
33.0	300



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Heavy-duty construction. Made of semi-steel. Back-seating is provided for repacking while valve is under pressure. Seat is made of soft metal alloy-swivel and self-aligning. Ample ports provide full pipe capacity. Hand wheels proportioned for easy operation.

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PRESS BRIEFS

Cincinnati Store Installs Modern Air Conditioning

A NEW 1800 ton air conditioning plant will soon be in full operation in the John Shillito Department store in Cincinnati, providing associates and customers the ultimate in year round air conditioning comfort. Costing more than a million dollars, the unit is one of the first roof-centered air conditioning units in the country.

Two 900-ton centrifugal compressors do all the cooling work and the tremendous tonnage provides power to convert hot air to just the right degree of coolness. The system chills 5470 gallons of water each minute to maintain desired comfortable temperatures and relative humidity of 45 to 50 percent.

There are 36 zones throughout the store which are independently thermostatically controlled and an electronic system in the roof equipment room continually adjusts the temperature and humidity of these areas to their scientifically pre-determined levels. The present adjusting of these area controls will insure the future comfort of all associates and customers. The new unit replaces forty individual units which were formerly scattered throughout the building.

New Food Processing And Storage Plant

THE new Bakersfield Food Company at Bakersfield, Calif. headed by Marvin Berry, long prominent in the ice and cold storage field in Bakersfield, is building a $583,000 food processing and cold storage plant at 220 Industrial Street in that city.

Irrigated crops moving into cold storage for national distribution and export around Bakersfield include most of the deciduous fruits, all citrus fruits, most vegetables; and in the protein field, lamb, mutton, beef and poultry fed on irrigated crops of the San Joaquin Valley, a desert domain flooded with irrigation water from the High Sierras, and cooled indoors to an easy 70 degrees by simple evaporative coolers, effective in the dry heat, when the temperature outside is well over 100 degrees and sometimes reaches 115.

All windows are closed in the hot summer, and a fan draws cold air through a water-soaked pad of excelsior, both in a box, in a window frame to replace the window.

ICC Suspends Demurrage Increase

THE Interstate Commerce Commission has suspended for up to seven months the demurrage increase sought by the nation's railroads. This action was taken in the face of protests filed with the Commission from nearly 400 shippers and shipping groups, including the National Association of Refrigerated Warehouses.

Representatives of the NARW told the ICC that the conditions which the railroads claim higher demurrage rates will help to correct (car shortages) "are frequently the results of the railroad's failure to provide complete switching and clerical services on Saturdays, Sundays and holidays," and that often "cars are not delivered on time, which results in bunching of inbound cars, resulting in increased unloading expenses to warehousemen."

The proposed increase would boost demurrage rates to $4.00 a day for the first two days following expiration of free time; $7.00 a day for the next two days and $10.00 a day thereafter. NARW Quick Sheet.

Kroger Plans New St. Louis Distribution Center

THE Kroger Company has purchased a 63-acre tract in Hazelwood as the site of the company's new multi-million dollar food distribution center in St. Louis. Kroger stores within a 75-mile radius of St. Louis will be served by the center upon completion of the project. Each section of the building will be designed to do a specific job. The latest available equipment for the most efficient and economic handling of food will be incorporated into the structure.

The center will replace facilities now located at South 39th Street which have been company headquarters for the 44 years Kroger has been part of the St. Louis business activity. Huge, high-ceilinged areas for "dry" groceries, below-zero freezers for frozen foods, an air conditioned section for produce, special "wet" and "dry" refrigated rooms for fresh fruits and vegetables, and special banana ripening rooms will be provided.

Dock areas for rail and truck movements are to be totally enclosed for protection from the weather and temperature controlled during the winter months.

North American Car Builds 100 Reefers

CERTIFICATES of necessity for accelerated tax amortization were issued to North American Car Corporation, Chicago, in August by the Office of Defense Mobilization. The percentage of tax amortization amounted to 85% for the construction of approximately 100 railroad refrigerator cars. The amount of certification was $780,000.00.

The purpose of the amortization program is to expand private industry's productive capacity to meet mobilization goals. The percentage authorized depends on the type of facility, the amount of expansion required in the event of a national emergency, the probable usefulness of the plant for other than defense purposes, and the degree of incentive to encourage such expansion.

Milwaukee may Restrict Water for Air Conditioning

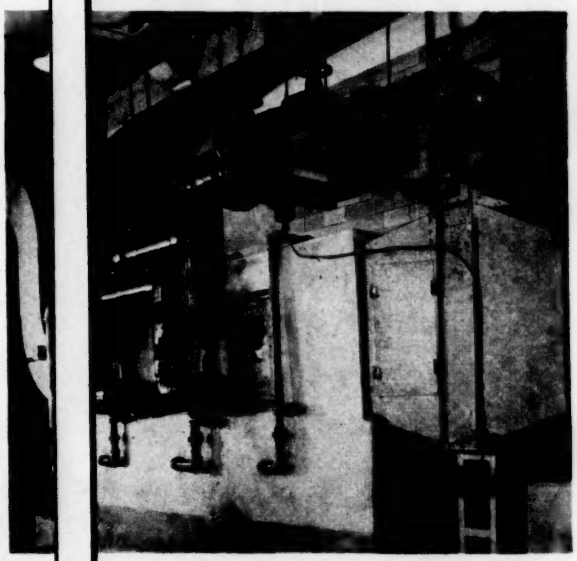
THE CITY of Milwaukee should place restrictions on the use of water for air conditioning, the common council's utilities committee was told recently. The report of a special committee headed by City Engineer Eugene A Schmidt said that increased use of water cooled air conditioning units placed a heavy demand on the city's water system. Air conditioners used nearly 10% of the water pumped on the peak day in 1955, the report said.

Ordinances are pending before the utilities committee to require the installation of water conserving devices, known as cooling towers, with large air conditioning systems, and to levy a special water charge if the devices are not installed.

New Frozen Food Plant

THE GENERAL Foods Corporation has taken initial steps to establish a frozen foods processing plant on a 10-acre tract in East Oxnard, Calif. The plant will cost about one million dollars and will employ 200 to 300 workers. The City Council has approved a record survey on the site and set up conditions which the city and corporation have already signed. A General Foods representative indicated that the freezing and cold storage operations will be conducted by the Union Ice Co., Oxnard.

GENUINE
OZITE
PIPE COVERING
INSULATION



CUTS POWER CONSUMPTION

- APPLIES EASILY WITHOUT WASTE
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OZITE All-Hair felt is easy to install for curves, straight pipes or valves... applies without waste ...provides maximum capacity of refrigeration units... Ozite is practically indestructible.

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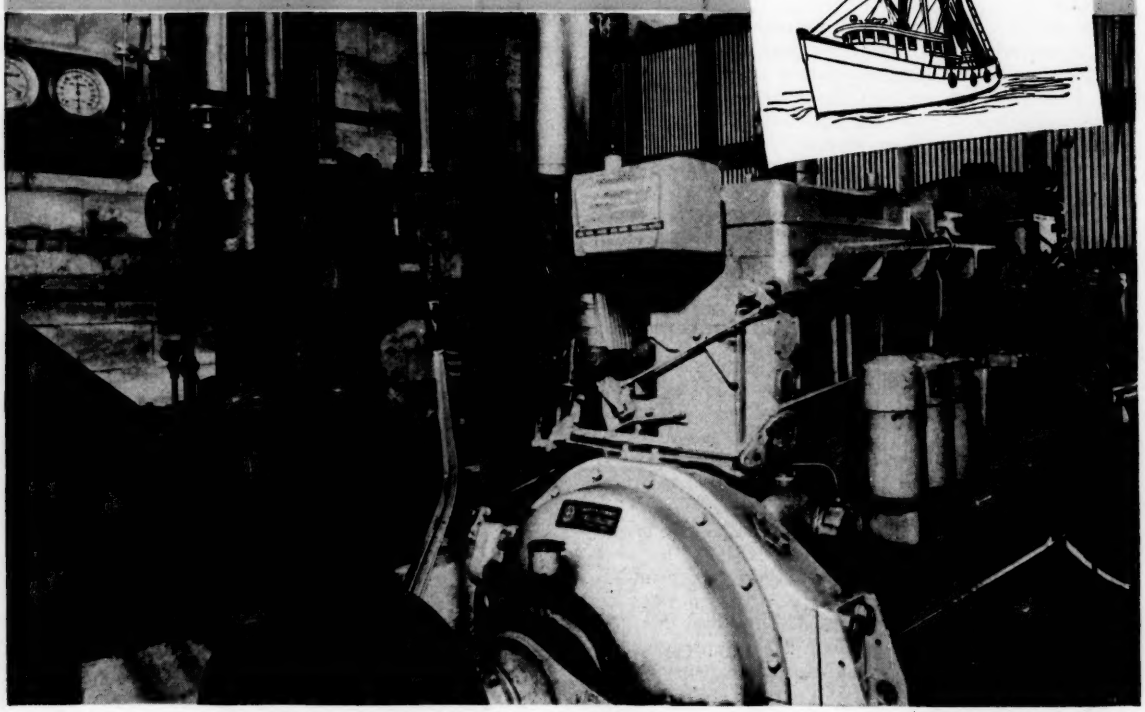
SAME DEPENDABLE CAT* POWER
in shrimp boats and ice plant



J. L. Stovall, of Fernandina Beach, Florida, operates the Fernandina Ice Co. plant, supplying 35 tons of ice per day to shrimpers and townspeople. He also owns four shrimp boats. Both the ice plant and the shrimpers are powered by Cat Engines.

Says Mr. Stovall: "We got such good service from Cat Diesels in our boats that we bought a Caterpillar D13000 to power the ice plant. If there's a better engine built I'd like to see it. We had one engine of another make in a shrimp trawler and we'll never buy another. Since then we've bought all Caterpillar Diesels, and will in the future when we need engines. They do a good job under heavy load conditions, 24 hours a day, month after month."

Two of the shrimp boats in the fleet are powered by D13000 Marine Diesels and two have Cat D337 Engines. The Caterpillar Engine in the ice plant drives a generator which powers the air blower, water pump, agitator, brine pump, crusher and all lighting, and drives a 9 x 9 compressor.

It's natural to turn to Caterpillar power for refrigeration. There's rugged dependability built into Cat Engines, whether for marine or industrial use. Furthermore, Cat Engines are easy to take care of. Their simple fuel system and dependable four-cycle design keep them on the job with a minimum of attention. They have no cylinder ports or air boxes to clean.

Your Caterpillar Dealer has a whole new line of Cat Diesels, which can produce up to 650 HP (maximum output capacity). And he backs their long, economical work life with round-the-clock service and parts. Call him today.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

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MODERN HEAVY-DUTY POWER

In the Spotlight

THE SECOND Annual Buyer's Directory for the Industrial Refrigeration Industry is published in this issue, page 37. It consists of a list of products used in the industry, manufacturers of these products and their branch offices, and trade names identified with certain makers' products. This provides an up-to-date compilation of information which will be useful to readers throughout the year.

A TRIBUTE to the remarkable progress made by the U. S. brewing industry since Prohibition days will be found in "Refrigerating the Modern Brewery," an article by George B. Bright Jr. and Boyd Kitts, starting on page 13. This industry, among the first to apply refrigeration for product improvement, continues to utilize the science not only toward process quality control, but also for purposes of production economies. Some unique devices engineered by the late Geo. B. Bright Sr. and his firm are described in this article by his son and the Stroh Brewery Superintendent of Maintenance.

THE REFRIGERATION Machinery Industry in 1954 added by manufacture $1,006 million, an increase of 71 percent over 1947, according to preliminary report of Census of Manufacturers, from figures obtained by the Bureau of the Census, Department of Commerce. The report is summarized with detailed figures on page 20.

SAFETY NOTE: In all the wars in which the United States was engaged from 1775 to 1955 there were 1,130,393 fatalities; yet between 1900 and 1955 1,149,414 Americans died in United States highway accidents.

KELLY DANAHY, brewery chief and NAPRE chapter secretary injects the water vapor absorption system question into the educational discussion at the Edwards City Chapter. His compression plant contractor who also vends the controversial absorption system, from all indications has previously and successfully defended the use of this apparatus from Danahy's criticisms (see Industrial Refrigeration, September 1956, page 13). Now, however, the chief calls on his NAPRE buddies for their opinions. Some pointed observations are made by these users. See page 21.

BRINE COOLING of fish aboard a fishing vessel was the subject of an investigation by the Fishery Technological Laboratory of the U.S. Fish and Wildlife Service, and reported at an international meeting of fish processing technologists at Rotterdam. The more important factors of brine tanks, evaporators, and refrigeration machines are discussed. Discussion and results of the investigation are reported in the article starting on page 30.

FOURTH IN A series of six operating and maintenance articles, the NAPRE official feature deals with hermetic centrifugal units. More and more engineers are finding themselves responsible for this type of refrigerating plant, especially in the central station comfort air conditioning and industrial process refrigerating fields. This article starting on page 58, is another designed to acquaint the practical man with system components, the refrigeration cycle, of this type unit, and the equipment operation and care.

THE MEMPHIS Cold Storage Warehouse Company reached its golden anniversary this year and it not only celebrated that event, but also honored its chief engineer, Chas. A. Conley who has had the same period of service with the company. At a meeting of Tennessee Chapter No. 1, NAPRE official recognition of this was made in presentation of a testimonial to him. Details are given in story on page 70.

AIR CONDITIONING has been installed in the two large buildings of The American National Insurance Company, Galveston, Texas. The refrigeration load is carried by eight large compressors, each with nine cylinders. For details and pictures see page 84.

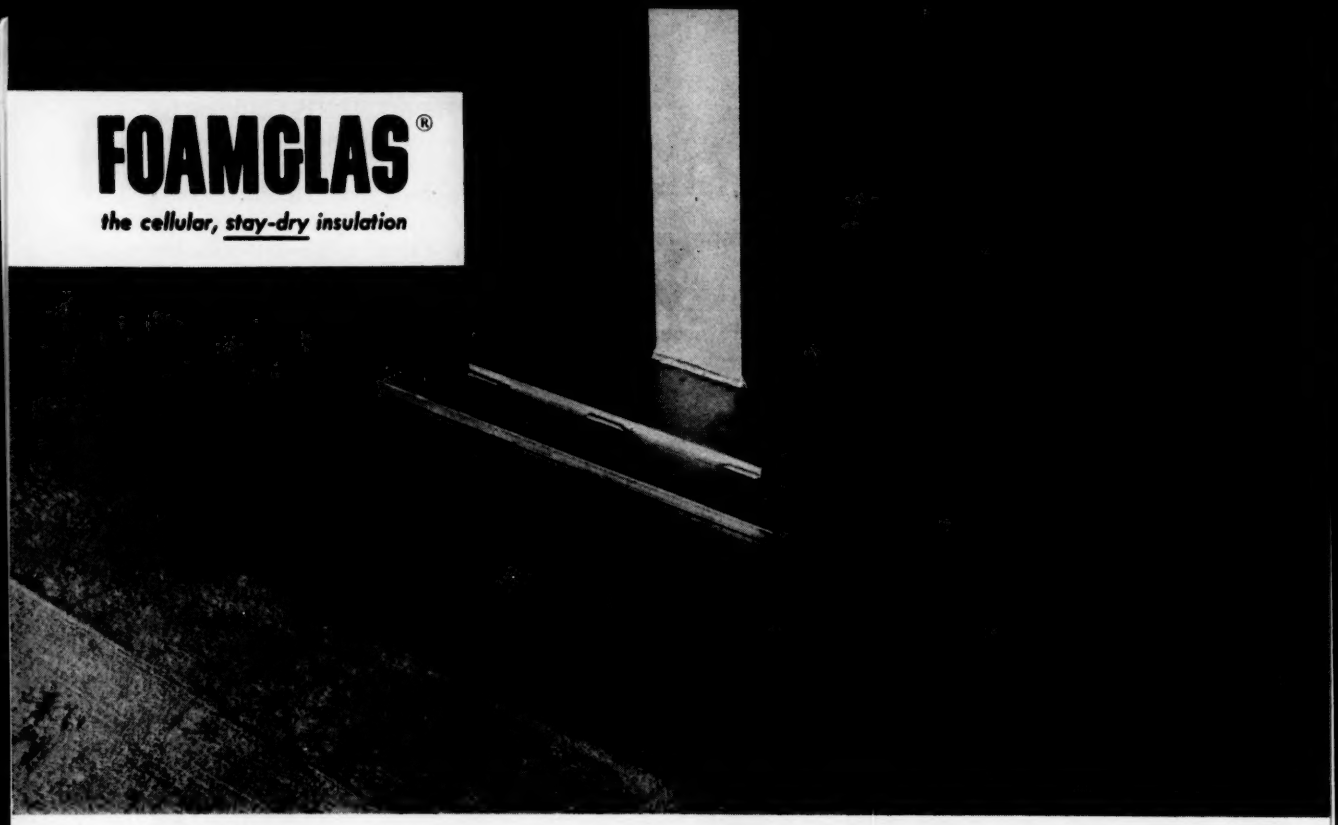
RETAIL grocery stores in this country now sell more ice cream than any other outlet. Not long ago, drug stores were the leading outlets. Not so today. The food markets sell five times as much as the drug stores. In 1955, super markets sold 200 million gallons of ice cream, which represented 300 million dollars in sales.

A HEAD COOLER is reported for use in hot weather that acts for hours. It consists of a hat of foam-like plastic fabric with millions of tiny insulating spongelike cells. Hat is dipped in ice water, wrung out and worn. The cooling effect comes from moisture in the material evaporating slowly. Headpiece is crushproof and washable.

TENNIS ON ICE: How is your tennis? If you want to improve your play next time the sun comes out keep the balls in your refrigerator the Wimbledon way. Say the Lawn Tennis Association — who demand that tennis balls are kept 'on ice' during championships — "If tennis balls get overheated, they become too lively — the cooler they are the better your game will be."

FOAMGLAS®

the cellular, stay-dry insulation



President Carl Steimle of Southern Michigan Cold Storage says...

"The weight of our new warehouse actually rests on FOAMGLAS floor insulation"

"FOAMGLAS floor insulation actually supports much of the weight of our new refrigerated warehouse." That's the report from Carl Steimle, president of Southern Michigan Cold Storage Company, Sodus, Michigan. They picked strong, stay-dry FOAMGLAS to insulate not only the floor, but also the roof, ceilings and all walls of the new building, first stage in a $1½ million building program.

This unique all glass insulation has a compressive strength of over 7 tons per square foot. Mr. Steimle says, "That made it possible to prevent thermal 'short circuits' by putting insulation *between* all load bearing columns and other structural members. All columns bear directly on FOAMGLAS without reducing its insulating performance."

FOAMGLAS can't absorb the moisture that cuts efficiency of other insulations. "The result," concludes Mr. Steimle, "is *constant*, precise control of temperatures (from —35 to +35F°), and we don't have the headache of recurring insulation replacement."

These benefits will be *yours* when you insulate your buildings, piping or equipment with FOAMGLAS. Prove it to yourself with six simple tests which you can perform in your own office. Write today for a free sample and complete testing directions.

Pittsburgh Corning Corporation

Dept. T-106, One Gateway Center
Pittsburgh 22, Pennsylvania

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Two layers of 4" FOAMGLAS insulate the entire floor area. There are no thermal "short circuits" since all load bearing columns rest directly on this remarkably strong insulation (see close-up, above).

PC® Also manufacturers of PC Glass Blocks

Refrigerating the Modern Brewery

The Stroh Brewery Co., Detroit

FIRE-BREWED beer, a 106 year-old process which distinguishes the Stroh Brewery Co. of Detroit among American's leading brewers, is quality controlled from the brew kettles to consumer by modern refrigerating equipment and some rather unique applications of refrigerating science. Increasing capacity from one million to three million barrels per year in the post-WW II period has required the firm to expand facilities rather rapidly. Helping somewhat in overcoming expansion headaches, were the opportunities of applying latest equipment and ideas as they became known to the industry in such matters as materials handling, engineering economics, production efficiency, and by product reclaiming.

Refrigerating science is applied in a sense in all four. As an example: a primary and bulk refrigeration media in brewing is water. It is also a prime ingredient. Its use involves improved materials handling (the H_2O itself), contributes to more economical engineering operations and to efficient product processing. Use of refrigeration in carbon dioxide collection and CO_2 reuse for carbonating and bottling can certainly be recognized as by-product reclaiming and improvement of production methods. Other utility uses of refrigeration will be easily recognized in the following account.

G. B. Bright, Jr.

Boyd Kitts

Geo. B. Bright, Jr. is a Refrigerating Engineer for the Geo. B. Bright Co., a firm established by his late father. The Bright Co. is Consultant to the Stroh Brewing Co. "Bud", as Bright, Jr. is called, is active with NAPRE in Michigan. He is also an ASRE member.

Boyd Kitts, Co-author, is the Superintendent of Maintenance for the Stroh Brewery Co. Also an active member, Kitts serves the Michigan No. 1 Chapter NAPRE at Detroit as instructor for the *Basic Refrigeration* classes conducted there in the Wilbur Wright Trade School under NAPRE auspices.

G. B. BRIGHT Jr.
Refrigerating Engineer
BOYD KITTS
Maintenance Supt., Stroh's

One of the pioneers in the great American cavalcade of the art, The Stroh Brewery Co., Detroit, Michigan, employs a most unique sales approach in its theme, "America's only *fire-brewed* beer . . . fire-brewed at 2000 degrees". The growth and progress of The Stroh Brewery Co. has been consistent over a long period, dating back 106 years; and this has been greatly accentuated in more recent years, placing it among the larger brewers of America's famous name beers. This firm's concept of modernity is exemplified by its pride

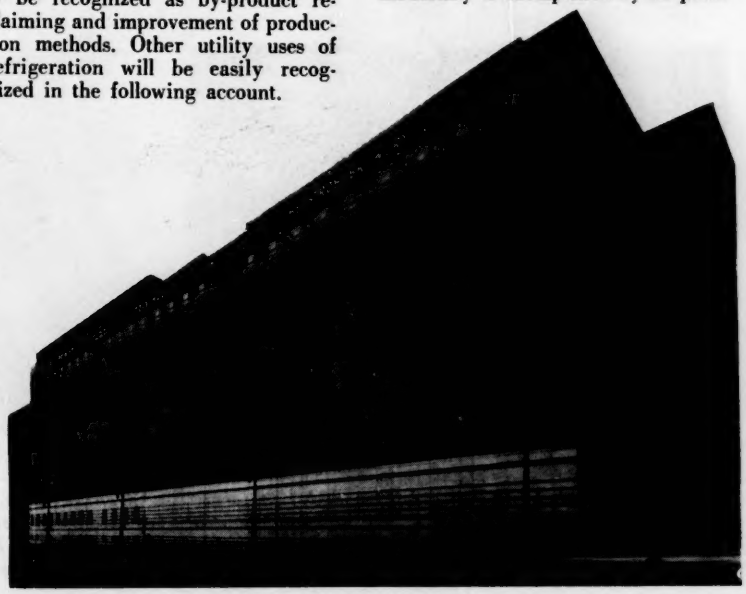


Fig. 1—Six of nineteen 250-bbl kettles in the Brew House. Each kettle is direct oil fired, rather than the conventional indirect heat source.

in distinguished appurtenances and untiring efforts in superb housekeeping. This is particularly the case in its use of stainless steel wherever possible to adapt it to its equipment, apparatus and appointments to ensure the ultimate in perfection of its product, and immaculate cleanliness.

Stroh History

The Stroh Brewery Company was founded in 1850 by Bernard Stroh, grandfather of John W. Stroh, now President. Bernard Stroh had worked as an apprentice brewer under his father and grandfather in Europe. When he attained the skill of brewmaster, he began travelling through all parts of the old country, working in many breweries, tasting many brews. Finally, he made his decision regarding the type of beer he would like to brew when he owned his own brewery. That beer according to his grandson is the same type of Stroh's beer on the market today — a "Bohemian style, light lager beer".

After making his decision, Bernard Stroh headed for South America, but finding the climate not to his liking, and the water unsuitable for brewing purposes, he came to the United States with full intentions of settling in Chicago. Upon his arrival in Detroit, however, he decided to open his brewery there because he was so favorably impressed with the water supply. Detroit's water comes from one of the purest lakes in the world — Lake St. Clair.

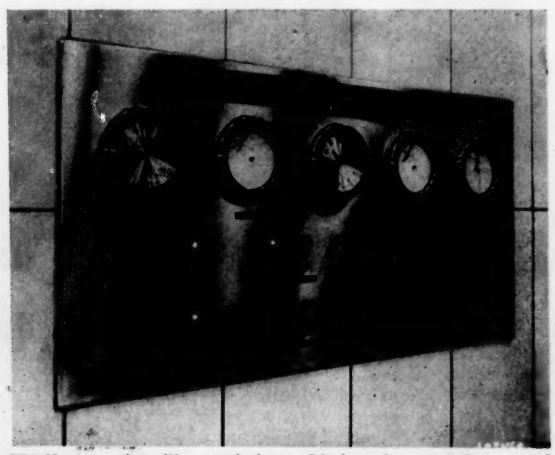
Brewing By The Barrel

So, speaking with a German accent, he went out among the English, Irish and Scotch, who predominated the area at that time, and found they were drinking porter, ale, and stout. He interested them in his light lager type beer, and after creating a demand for it, began brewing beer on Catherine and Hastings Streets, which at that time was the city limits of Detroit. When the beer was ready for consumption, Bernard Stroh delivered it in a wheelbarrow, one barrel at a time.

From this humble beginning, The Stroh Brewery Company has grown to its present stature in the brewing industry, and saleswise, is ranked in eleventh place among United States brewers. The Stroh Brewery Co. is still owned and actively managed by the direct descendants of its founder, and Stroh's beer has been brewed by three generations of the same family of brewmasters, father son, and grandson. The brewing of a quality product is much more than a commercial enterprise with Stroh's — it is a tradition of 106 years standing.

When it became apparent in 1910 that a new brew house would be needed, Brewmaster Otto Rosenbusch was sent to Europe to visit the celebrated brewing centers, test the beers, and inspect the various pieces of brewing equipment. He returned with the information that the finest beers

Fig. 2 (left) — One heat exchanger and two larger plate coolers make up a 250-ton set of cooling apparatus in the air conditioned Wort Cooler Room. Compact heat exchanger in right foreground is one of Walker-Wallace units. Two of four Mojonnier stainless steel coolers are visible in the background. Fig. 3 (right) — Wort Cooler Room instruments and equipment control stations are mounted in this stainless panel board.



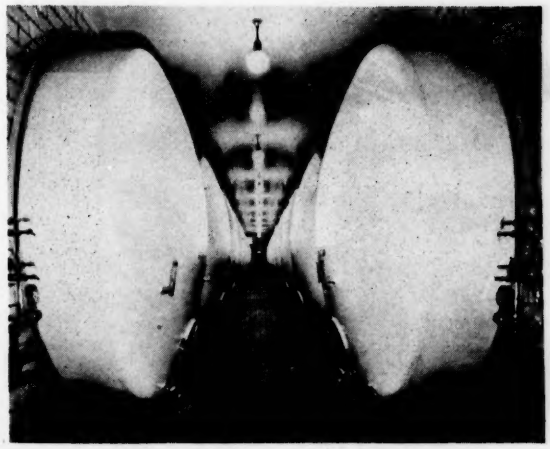


Fig. 4 — Closed fermenter cellars are arranged with twin rows of horizontal glass-lined tanks bulk-headed into a tile-lined work aisle. Instruments, valve gear and line circling the tank at each side are a portion of the CO_2 collection system for reclaiming this by-product.

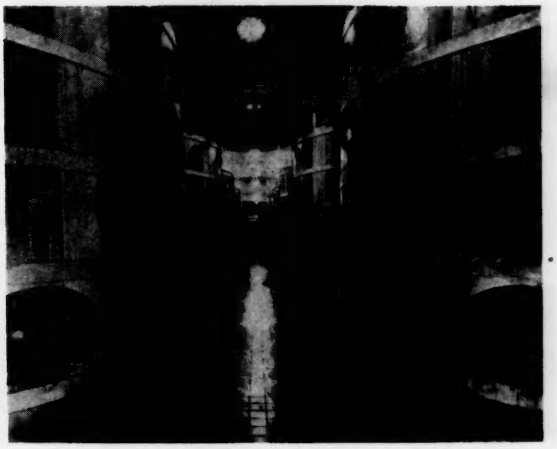


Fig. 5 — Open type fermenting cellars contain vertical wood tub-like tanks. Unique refrigeration applications in these cellars are the direct expansion (liquid NH_3) attemporator rings in the tubs, and the plenumizers for removing CO_2 and pressurizing the cellars themselves.

he found were brewed in direct fired kettles. He recommended, therefore, that in building the new brew house, oil fired wort kettles should be installed. This was done.

In 1914, there came into being the famous Stroh fire kettles when six such vessels were placed in operation in the then new building (see Fig. 1), and an additional six added in 1947. Another seven (making 19 in all), are presently being installed in an addition to the brew house originally erected in 1912-1914.

Originally, the brew house consisted of six 250-bbl. oil-fired brew kettles, one mash tub and two lauter tubs. In 1947 when the six additional 250-bbl. oil-fired kettles were installed, they were followed by two new lauter tubs, and at a later date one new mash tub. In the new addition now under construction (in which will be installed seven new 250-bbl. oil-fired kettles) two new lauter tubs and one new scale hopper will be added along with the attendant auxiliaries.

Materials Handling

Grains will be supplied to the new addition by conveyor from the old Brew House. Wort cooling will be done in the old Brew House in a modernized Wort Cooling Room. Spent grains handling and hop straining facilities are also provided for in the Brew House.

In the old Brew House, spent grains are handled by screw and chain type conveyors. In the new Brew House, it is proposed to handle the spent grains with two Pondorff

Fig. 6 — Stockhouse refrigerating center. At left is a floor mounted Niagara blower unit typical of those used to cool the four floors of aging cellars in Stockhouse No. 6.

Vertical accumulators at right are equipped with two liquid pumps each which recirculate NH_3 to both attemporator coils and evaporative cooling surfaces in the fermenters. Insulation is aluminum jacketed Foamglass.

Fig. 7 — View over the tops of the open fermenters such as picture in Fig 5. Hanger rods seen over the top of the wood tanks support the attemporator rings within the fermenting beverage. Frosted lines close to the tank tops carry liquid ammonia to and from the atttemporator rings.

Heat gains through the building structure and that carried into the air by escaping CO_2, is removed by the Dimco fin coil located closest to the ceiling structure.

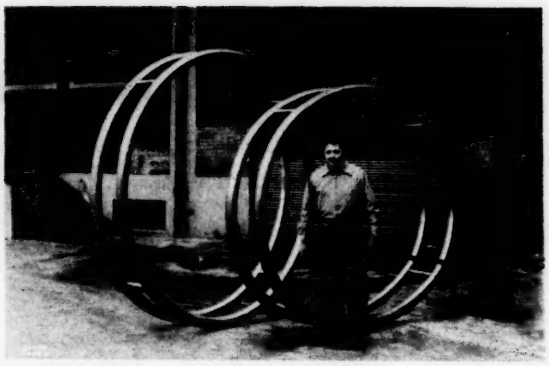


Fig. 8 — Anthony Bove, Jr., Dimco, poses with two sets of attemporator coils in order to give the reader an idea of the size of these units. Attemporator rings are heliarc welded 4-inch OD stainless steel.

units — these are a combination of one short screw conveyor which compresses the spent grains into a compact mass and then, by introducing steam, forces the compact mass through an 8-inch line to the spent grains hopper. A new 30-bbl. hop strainer was recently installed in the old Brew House, with space left for the installation of a duplicate strainer.

Wort Handling System

After the wort leaves the brew kettle, it is pumped to the top floor of the old Brew House into the hop strainer. Two stainless steel tanks receive the hot wort after it leaves the hop strainer. These tanks were connected in turn to stainless steel pumps which transfer the wort through the Paraflow heat exchangers; thence, over two compact plate coolers (see Fig. 2). The heat exchangers and the plate coolers have been arranged so that one heat exchanger serves two compact coolers all operating in a thoroughly air conditioned room. Fresh air is passed through mechanical and electronic filters, refrigerated coils, preheat and reheat steam coils, to supply the cooler room with conditioned air which prevents any condensate on walls or ceiling of Wort Cooler Room. Control of wort refrigeration, water, air conditioning and auxiliaries is from the control panel pictured in Fig. 3.

As noted, this arrangement provides two complete cooling units, each which is capable of cooling an 1130-bbl. brew in two hours. After the wort leaves the cooler pans, it is transferred by a stainless steel pump through 4-inch stainless steel lines to the settling cellars. After the wort leaves the settling cellars, some of it is fermented in closed fermenters (Fig. 4) and the balance in open fermenters (Fig. 5). Closed fermentation is utilized so that the CO_2 gas can be collected for use throughout the brewery. After fermentation, the beer is cooled and placed in aging tanks in the modern stock cellars where it is left to mature.

TABLE 1 — STOCK HOUSE ARRANGEMENTS AT STROH BREWERY CO., DETROIT, SHOWING CELLAR USES AND REFRIGERATION METHODS.

Buildings		Cellar Application			Refrigerated Surfaces					NH_3 Application	
STOCK HOUSE	YEAR CONSTRUCTED	FLOOR NO.	FERMENTER (Open)	FERMENTER (Closed)	AGING	ALUMINUM FIN COILS	CEILING HUNG BLOWER UNITS	FLOOR MOUNTED BLOWER UNITS	STAINLESS STEEL TANK COILS (ATTEMPORATORS)	FLOODED SYSTEM	LIQUID NH_3 RECIRCULATION
No. 3	1950*	1	x			x			x	x	
		2	x			x			x	x	
		3	x			x			x	x	
		4	x			x			x	x	
No. 4	1948	1			x	x				x	
		2			x	x				x	
		3			x	x				x	
		4			x	x				x	
		5			x	x				x	
		6	x			x			x	x	x
		7		x		x				x	
No. 5	1955	1			x		x			x	
		2			x		x			x	
		3			x		x			x	
		4			x		x			x	
		5			x		x			x	
		6			x		x			x	
		7	x			x			x	x	x
		8		x		x				x	
No. 6	1956	1			x			x		x	
		2			x			x		x	
		3			x			x		x	
		4			x			x		x	
		5	x			x			x		x
		6	x			x			x		x
		7		x				x			

*Building Conversion

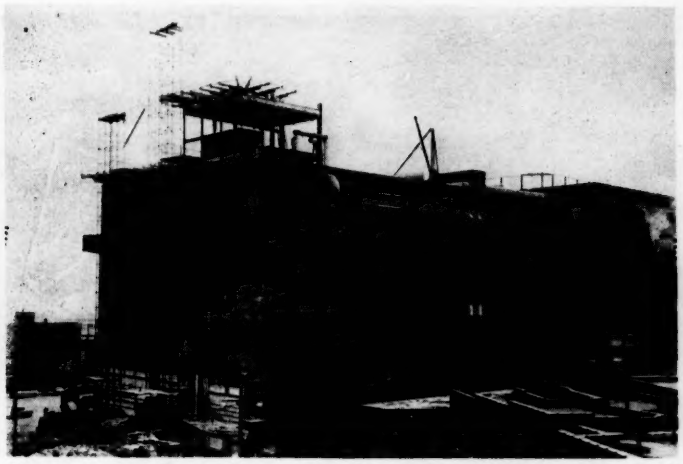


Fig. 9 — Stroh's stockhouse No. 6 under construction. Glass lined tank being raised in position is one of 20 installed in the new closed fermenting cellar. Insulation of the stockhouse walls is five inches of Foamglass installed in two layer work.

When it is aged and mellowed, it is then cooled, carbonated, filtered, packaged and distributed to the consumer.

Cleaning Materials System

In the layout of this equipment, special consideration was given to arrange the system so that it could be cleaned with a minimum of effort. A solution tank was located at a strategic point, enabling pumping from this tank in such a manner that the solution entered the wort system lines just below the hot wort tanks, and circulated through all lines, pumps, heat exchangers and coolers, as well as lines which deliver wort to the cellars.

Water — Basic Ingredient and Primary Refrigerant

One feature worthy of note in connection with the heat exchangers and coolers, is the water and heat saving arrangement. Water cycle in the Brew House is as follows: City water is taken into the compact plate coolers where it performs some useful work in cooling the wort. It is then stored in large tanks near the top of the building, to be used in the brewing process and other applications. One of these tanks in particular supplies sparge water for the following brew. A pump forces the water through a heat exchanger where it is heated to approximately 170 F prior to brewing. Thus, heat removed by this city water acting as a refrigerant, is the initial heat required in the sparge water for the following brew; that is, initial heating for a new brew is supplied from the wort cooling process of the brew ahead.

Refrigeration in Brewing

First point of refrigeration in the brewing process is wort cooling, which in this case is done with water and ammonia. The ammonia sections of the compact plate coolers shown in Fig. 2 are capable of producing 250 tons of refrigeration for each cooler. Inasmuch as only two coolers are used at a time, the maximum ammonia cooling load is around 500 tons. This is based on 80 F water. The tonnage demand diminishes as the water becomes colder; proportionately so to the decrease in temperature of the water.

This wort cooling load is taken care of by an ammonia liquid pumping system located at a building level below the wort cooler room (see Fig. 6). Liquid ammonia is admitted by a pilot-operated valve to a surge drum where a level is maintained, keeping a constant head on the liquid pumps. The ammonia is then pumped through the refrigerant section, flowing downward. It returns with the suction vapor to the surge drum where the excess ammonia liquid is separated from the suction vapor and is recirculated through the system. The suction gas returns to the refrigerating machines in the engine room.

The object in having the ammonia flow down through the refrigerant section of the cooler is that, when the coolers are shut down for cleaning, all of the ammonia will flow back to the surge drum by gravity. This arrangement leaves the compact plate coolers free of ammonia; thus avoiding the danger of rupturing the cooler during the cleaning process.

Cellar Refrigeration

Very little cooling is done in the settling cellars . . . only sufficient to take care of the heat leakage through insulation, doors, windows, etc. However, in the fermenting cellars, considerable heat generated in the fermentation process, must be removed

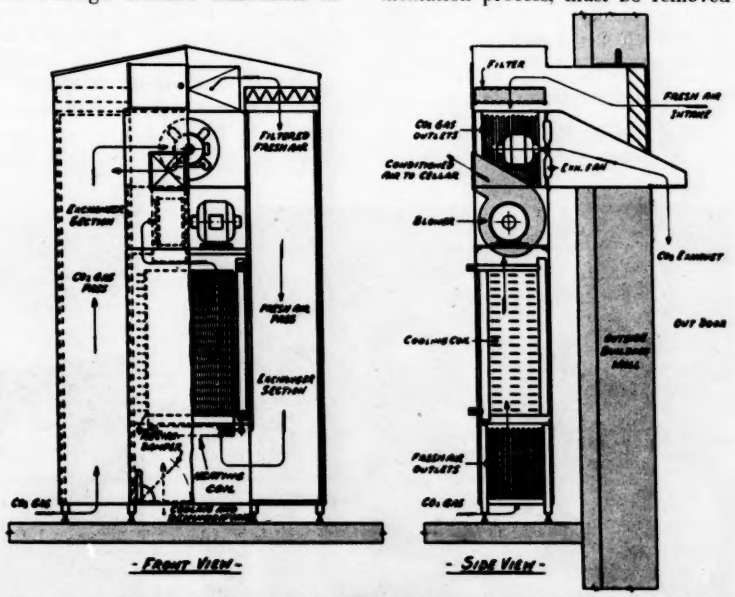
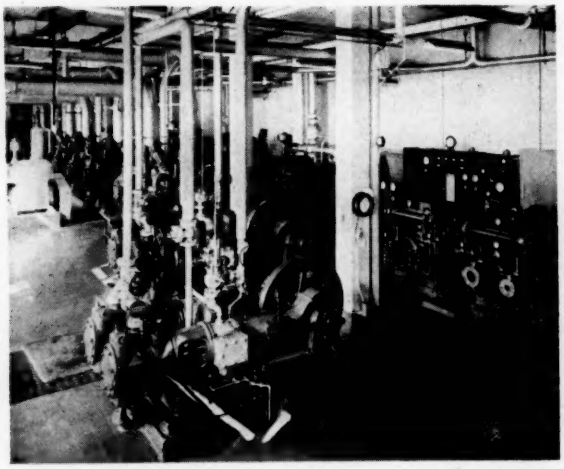
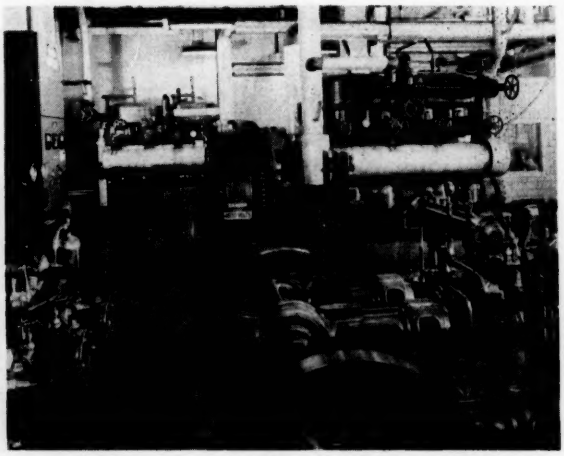


Fig. 10 — Sectional views of the Dimco Plenumizers installed in the open fermenting cellars. With the exception of the refrigerating coils, this whole unit is constructed of copper and redwood. Fresh air is conditioned by this device and supplied to the cellar. This air keeps the room under pressure and forces CO_2 out through the same unit. As the CO_2 moves through the unit it helps cool the incoming air.





Figs. 11 and 12 — In the background, behind the CO_2 and air compressors, are located three Uniflow-engine-driven Carbondale 2-stage compressors. These machines represent the refrigeration tonnage at Stroh's prior to the recent expansion program. In the figure at the right may be seen the two Frick Company 4-cyl. VSA compressors used principally for wort cooling applications. By an arrangement of dual suctions and individual cylinder pocketing, eight increments of control are achieved even though these machines are synchronous motor driven.

by refrigeration. Some may be done by attemperation during the fermenting process, or it may be done after fermentation through coolers, or a combination of both.

Each open fermenting tank, such as pictured in Fig. 7, is equipped with two 4-inch stainless steel attemperator coils as shown in Fig. 8. These coils operate on a flooded NH_3 system and may be used for attemperation or cooling. Direct application of NH_3 for attemperation may be considered unique, as indirect cooling media such as brines or glycols are more commonly used.

More Refrigerating

Upon leaving the fermenters, the beer is cooled and dropped into the aging cellars. Considerable refrigeration is required in the cooling process because it is customary to move the beer from the fermenters to the aging tanks quite rapidly. Shell and tube coolers are used for this purpose. Very little refrigeration is required in the stock cellars as, actually, the heat leakage is mostly through insulation, doors, windows, etc., constituting a greater portion of the load.

After the beer is properly aged and is ready for marketing, it is drawn from the aging tanks, cooled and filtered. Actually, the cooling process consists of lowering the temperature a few degrees prior to filtering, removing any heat that may have been picked up during the process of handling. That portion of the beer which is pumped to the bottle shop enters what is known as the Government Cellar where it is stored in large glass-lined tanks before it is bottled or canned, and then packaged. The Government Cellar is an appropriate title since this is where the product is metered for Internal Revenue Bureau tax collection.

Stock House Expansions

In actuality, fermenting, aging and other cellars are located at Stroh's in a series of stock houses. This group resulted in the impressive structure which is outlined on the title page of this article. Post-WW II construction for Stroh Cellars is shown in Table I. Fig. 9 shows Stock House No. 6 under construction.

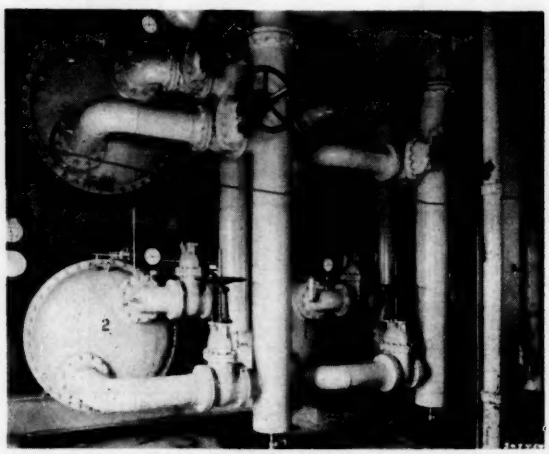


Fig. 13 — Four new shell and tube condensers installed on the 8th floor of a Stroh stockhouse. Together with the eight existing condensers they provide condensing capacity for 3500 tons.

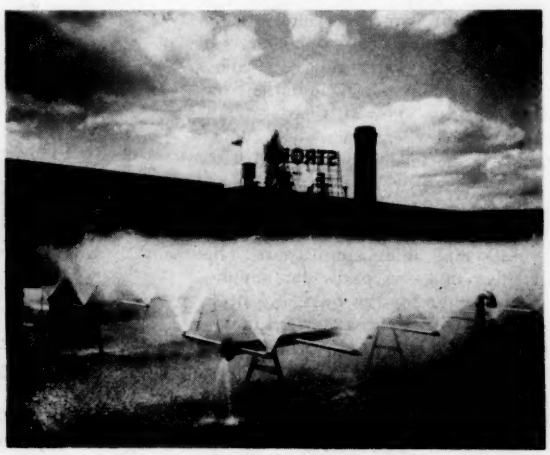


Fig. 14 — New section added to the spray deck. This spray deck which extends over 40 percent of the stockhouse roofs provides the evaporative cooling for the condensing plant.

Plenumizers

All open fermenting cellars are equipped with Dimco Plenumizers. The purpose of these units is to keep the cellar under a positive pressure,

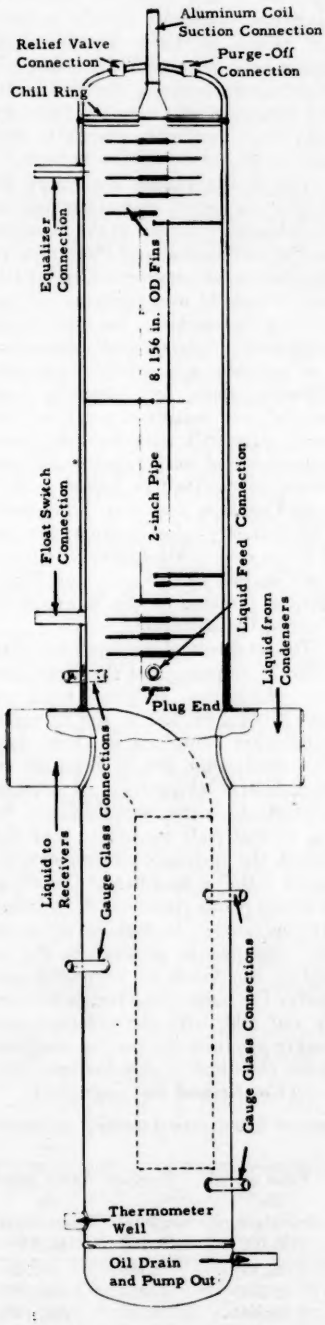


Fig. 15 — Construction drawing used with a single purger supplied to the Stroh condensing plant. This single vessel with its aluminum fin evaporative surface eliminates the use of a battery of smaller purgers.

Fig. 16 — View of the bottle shop at the Stroh Brewery Company shows the column-less building structure which enables most effective floor use. The bottling line consists of the soaker and washer in one unit, paralleled by a pasteurizer. The pasteurizer in the foreground handles both cans and bottles simultaneously.

effecting a heat exchange between the CO_2 laden air being taken from the cellar and the fresh air being brought into the cellar (see Fig. 10 for details of Plenumizer construction). Incoming filtered air is further lowered in temperature by a cooling coil in the Plenumizer unit. Refrigeration is supplied to these units from the attemperator system which, as mentioned, is supplied NH_3 from a pump operated recirculating system. These units are also equipped with steam heating coils for winter operation.

Engine Room Equipment

Principal refrigeration equipment in the engine room consists of three 300-ton Carbondale ammonia compressors driven by Uniflow steam engines, running condensing; and, two 300-ton Frick ammonia compressors driven by two 500-hp synchronous motors (Figs. 11 & 12 show this machinery in two half engine room views).

Each Frick Co. compressor consists of four cylinders, 14 in. diam. x 12 in. stroke, operating at 257 rpm. Each cylinder has clearance pockets, and each machine is fitted with dual suction. The hookup is so arranged that a part of each machine can be operated on one pressure and the other part at another pressure. Together, the clearance pockets and dual suction give eight increments of control. This is very necessary due to the operation of the wort coolers. In the summertime wort cooling might occupy the whole machine capacity, but as the water temperature becomes cooler, one half cylinder can be dropped off at a time by the use of the clearance pockets.

The NH_3 plant is customarily operated under three pressures: 30 psig for the cooling of the cellars; 40 psig for the beer coolers handling beer in process — this also includes attemperator rings; 55 psig for the compact plate wort coolers. All machines are hooked up with dual suctions, and three suction lines are piped into the engine room, giving flexibility to meet any condition desired or required. At 55 lb. suction pressure, the tonnage climbs quite rapidly, and with a fully loaded machine the 500 hp synchronous motors for the Frick units naturally reach close proximity to their capacity.

Condensers Added

There are 12 shell and tube condensers similar to those in Fig. 13 totalling about 3,500 tons capacity. Circulating pumps for these condensers are capable of handling 10,500 gallons of water per minute. These condensers and their pumps are located on the eighth floor of a stock house just below the spray deck. This spray pond which extends over the top of two stock houses, is the only means used for cooling the condensing water. A portion of the new deck recently added is shown in Fig. 14. The water cycle is from a surge tank, through the pumps, through the condensers to the spray deck and then back to the surge tank. Water is treated with chemicals for scale, corrosion and algae.

Special Purger Built

Purging of non-condensables from a system this size posed the problem of a number of automatic or manually operated purgers arranged like a battery, since most manufacturers did not stock single large units. To meet this condition, a single large purge unit was designed and constructed on the job. Interior low temperature surface for condensing NH_3 under conditions ideal for liberating the non-condensables, is provided by a DIMCO aluminum fin pipe surface. For details, refer to Fig. 15.

Steam Generating

Steam for process and the Carbondale-Uniflow combination is supplied by two 40,000 lb/hr. S. & G. steam generators, with one 90,000 lb/hr. deaerating heater. The boilers are fired by either natural gas or fuel oil. They supply steam for the Brew House and Bottle Shop, as well as heating during the winter.

Bottle Shop

A new bottle shop was erected in 1949-50. A unique feature of this bottle shop perhaps is that the bottling floor is completely covered by one span, leaving the work floor free of columns and rendering it much more accessible for putting in large equipment such as bottle washers, pasteurizers, etc. (see Fig. 16). It is believed that this is the only bottle shop so constructed in this country. The equipment originally consisted of six complete bottling lines and one can line, to which recently has been added three more bottling lines and one can line, making a present total of nine bottling lines and two can lines.

During the past several years, the production capacity has expanded from 1,000,000 barrels to the present capacity of approximately 3,000,000 barrels. Due to the foresight of the management who had developed a long range program projected into the future, it has been possible to meet the increased demand for production by expanding according to the projected plans.

Ice Plant Boycotted

DESPITE one of the season's worst heat waves, citizens of Nuevo Laredo, Mexico recently boycotted ice because the local ice plant had doubled prices. Ice boxes were empty, food was spoiling, water and cold drinks were being consumed hot and some said there was a danger to public health as a result.

Refrigeration Machinery Industry Shows Big Gain Over Last Report

DURING 1954, value added by manufacture in the Refrigeration Machinery Industry amounted to $1,006 million, an increase of 71 percent over 1947, according to preliminary results obtained from the 1954 Census of Manufactures conducted by the Bureau of the Census, Department of Commerce. The report series MC-35-6.7 was issued September 1956 by the U.S. Dept. of Commerce and the Bureau of the Census, Washington, D.C. Average 1954 employment in this industry of 128.3 thousand was substantially the same as 1947 when the last Census of Manufactures was taken. "Value added" is derived by subtracting the cost of materials, etc., from the value of shipments. It avoids, therefore, the duplication in the value of shipments which results from the use of products of some establishments as materials by others and is the best value measure available for comparing the relative economic importance of manufacturing among industries and geographic areas. Changes between the two Census years for other key measures of activity for the industry are shown in Table 1. No adjustments have been made for changes in price levels between the two years. All figures in this report are preliminary and, therefore, subject to revision in the final industry bulletin.

TABLE 1 — PRODUCTION STATISTICS FOR REFRIGERATION MACHINERY INDUSTRY IN UNITED STATES — 1954 AND 1947.
(MONEY FIGURES AND MAN HOURS IN MILLIONS)

Item	1954	1947
Establishments	586	561
All employees		
Number (Average for the year)	128.3	128.7
Salaries and wages	567.1	378.6
Production Workers		
Number	98.9	107.8
Man-hours	194.5	219.0
Wages	397.0	297.8
Value added by manufacture	1,006.0	587.9
Capital expenditures, new	107.7	46.1

The Refrigeration Machinery Industry represents manufacturing establishments engaged in the manufacture of mechanical and absorption refrigerators for commercial, industrial, and household use, refrigeration machinery, ice-making machinery and equipment, refrigerated show-cases and cabinets and complete air-conditioning units for domestic, commercial, and industrial use. Establishments primarily manufacturing soda fountains and beer-dispensing equipment are classified in Industry 3997, Soda-Fountain and Bar Equipment. The industry classification for the Refrigeration Machinery Industry used in the 1954 Census of Manufactures is based on the Standard Industrial Classification.

The total cost of materials and total value of shipments of the Refrigeration Machinery Industry have not been published due to the extensive duplication contained in these data. This duplication results from the intra-industry shipments of certain products by some establishments for use as materials by others. For this reason, the "primary product specialization ratio" a measure of the extent to which plants classified in an industry "specialize" in making the products regarded as primary to the industry, could not be computed precisely. The ratio, however, is between 85 and 100, with the principal secondary products shipped by establishments classified in this industry con-

(Continued on page 83)

TABLE 2 — REGIONAL STATISTICS FOR REFRIGERATION MACHINERY INDUSTRY IN UNITED STATES 1954 AND 1947.

Region	Establishments	Number employees (1,000)	Value added by manufacture ($1,000)	Number employees (1,000)	Value added by manufacture ($1,000)
New England	27	7,525	62,431	6,183	26,403
Middle Atlantic	141	27,834	266,065	27,184	108,243
East North Central	169	67,510	486,664	76,242	362,300
West North Central	70	12,776	104,159	9,794	47,025
South Atlantic	32	2,210	12,593	*	*
East South Central	13	1,914	16,884	*	*
West South Central	50	2,761	24,925	*	*
Mountain	11	827	4,044	*	*
Pacific	73	3,899	28,242	4,192	*
United States	586	128,261	1,006,013	128,677	587,928

*Withheld to avoid disclosing figures for individual companies

Is the Water Vapor Absorption System a "Cure-all"?

Discussion by Practical Engineers Questions Economies of Certain Applications

Part II

WATER VAPOR absorption refrigeration has come to plague Kelly Danahy, chief engineer, Metropolitan Brewery. The Brewmaster wants the chief to use it for chilled water applications in wort cooling and fermentation control. The paymaster wants a similar system for air conditioning the accounting, sales and executive offices. Both had read of improved systems in INDUSTRIAL REFRIGERATION in "What's New," a monthly editorial feature on new product lines or developments.

Kelly is hopping mad. He resents the Brewmaster and front office inference that they know as much about engineering as himself. INDUSTRIAL REFRIGERATION draws his ire for making a "glory box" of the water vapor absorption system. He feels qualified as a critic because of his own experience in the dim past with NH_3 absorption systems in refinery and chemical plants.

To add insult to injury, at a pre-meeting dinner (Danahy is secretary) of the Edwards City NAPRE chapter, he is non-plussed by a hotel chief friend siding with the vendor on the merits of the system. Then, to really climax his indigestion, his vendor-contractor friend takes his arguments apart. All three, Kelly Danahy, John P. "Jack" Turner, Hotel Chief, and A. Ramsey "Scotty" MacDonald, Manufacturers Sales Engineer, arrive at this moment at the NAPRE meeting:

Danahy made a bee-line for T. Eugene Dziamianwicz, the Chapter's Instructor.

"Diz", saluted the chief, "I've got, as me friend Scotty would put it, a verra unusual problem. It will take only a few minutes to set this so-called engineer MacDonald straight, but as a special favor to me would you open the meetin' with the Question Box tonight?"

"Oh, oh, an argument with Scotty," exclaimed Diz. "With the two of you on opposite ends of this, it could go for all night. What does Pete say?" countered Diz, referring to Art Peterson, the chapter prexy.

"It'll be alright with Art", said Danahy, knowing the weight he had with the chapter officers as a result of his long Secretary tenure and his obliging, although sometimes gruff, ways.

"Well, who knows the story, Kelly"? asked Diz of Danahy. "You have a bunch of new applications to process tonight."

Danahy's hopes tumbled again when he glanced toward his desk in the hall, noted the accumulation of paper work, and in the same visual sweep noted the many new faces in the forward rows.

"Well, how do ye like that"? sputtered the brewery chief. "I haven't had a question since I can't remember when, — and now that lazily inclined membership committee snows me in tonight. Heck, I'll have to take care of 'em, but I think it unfair," he continued, pleased nevertheless with the sudden prospect of their chapter being back in the running for that membership trophy.

"Ask Jack Turner to give you the low-down. He's been prejudiced by Scotty, but he'll give you my picture plainer than the Scot," jibed Danahy, heading for the rostrum.

Without waiting for an affirmative nod from the President, and knowing that the secretary would have his way, Diz cornered Jack: "What's Danahy's latest?"

"Didn't he give you the word?" countered Jack, with a grin.

"In less than three minutes?" exclaimed Diz, both men breaking into laughs. Jack then described the arguments of both parties.

Prepares "Chalk Talk"

Halfway through his summary Jack was interrupted by the meeting call to order. Diz motioned him up front near his mobile blackboard. While the opening formalities took place, Jack whispered the balance of the story. With the board turned half away from his audience, Diz tabulated the arguments pro and con, Scotty vs. Danahy (see Table I). Seeing the instructor would not have time, Jack rose to the occasion and sketched his own system alongside the table being completed by Diz (see Fig. 1).

Diz got the educational session underway, the president having announced that a special problem would be presented in lieu of the refrigeration course review as he did not want to encroach on the featured speaker's time. The class instructor started the discussion off by referring to Table I which was pictured on the blackboard and announcing that the table would serve as a check-off list of the points he would like to bring out. He briefly told the group how the controversy came about and pointed out that the two outside columns of the table represented the "pros and cons" of the two participants in the argument.

As usual, in response to Diz' request for a show of hands, only one of the engineers was found who had been "in" on the contract discussion at his firm, when the equipment was purchased. This engineer was Vernon R. Summers, the building superintendent and chief engineer of the Emporium Department Store. Vern, as Summers is nicknamed, started off: "Can't disclose the figures which were considered by my employer when we put in our vapor absorption plant. I can tell you that the first cost compared favorably with several electric driven centrifugals that they considered.

Installation Costs Similar

"From my management's standpoint, there were two important phases which were discussed: The first was the question of cost of installation, and the second, cost of operation. The cost of installation was fairly reasonable and was one of the factors governing their selection."

The chapter instructor then asked for any comments on space and weight comparisons. He had no takers. He was about to comment on his own experiences, but remembering that it had been a number of years since his last close contact with the vapor type plant, and seeing that the chapter Secretary was about to inter-

rupt, he quickly moved on to the refrigerant characteristics list in his blackboard table. Again, he had no luck in locating any of the engineers who had delved very deeply into this subject.

Questions arose as to where data could be found on the efficiency of transferring heat from an amount of water vapor absorbed in a lithium bromide solution at one location and via this media to another point where additional heat releases the vapor, the vapor condensed, cooled twice, and sent out into the system again to pick up heat. Scotty surmised that he could possibly gather some data and bring it to another meeting. (He explained that it was really out of his department). Diz accepted his offer and Scotty promised data and pictorial literature at the next meeting.

"What about corrosion?" asked Diz. Again, there were no takers. Apparently there was little known among the practical engineers on whether inhibitors were used in the solution or special metals used in the equipment. To save time the instructor moved on to toxicity.

TABLE I — ARGUMENTS PRO AND CON ON THE VAPOR ABSORPTION REFRIGERATING SYSTEM, AS LISTED BY THE EDWARDS CITY NAPRE CHAPTER INSTRUCTOR

Scotty' Viewpoint	Topic or Function	Danahy's Arguments
Same cost as conventional centrifugals	First Cost	More expensive than conventional compression
Less weight Less space	Weight and Floor Space	More weight Same space
	Refrigerant Characteristics	
"Not a Refrigerant" therefore not classified by code	Absorbent	Corrosive
	Efficiency	Less efficient
Doubts toxicity	Safety	Toxic
Efficient in this application	Water Vapor	Nortoriously poor as refrigerant
	Energy Costs	
Recommend for application only where steady source of waste steam available	Steam	Public power less in cost than own steam production
Auxiliary power costs close between systems	Pump Power	Power for these exceeds conventional
Not familiar	Gas Engine Drive	Less in cost to operate than vapor plant
Conceded	Electric Motor Drive	Most efficient even with PF correction of synchronous motor
Uses 10% more condensing water	Heat Disposal	Uses 25% more condensing water
	Ease of Operation	
No wait, steam at hand	Start up	Wait to get steam up
Self starting Self securing	Shut down	Doubts unattended operation claim.
Similar problems to any system	Changeovers	Doubts vapor plant can handle heat to cooling and vice versa, daily
	Operating Characteristics	
New systems have eliminated vacuum problem	Vacuum Difficulties	Believes vacuum cannot be maintained without additional maintenance force
Finer controls on new machines, adaptation of old have overcome earlier troubles	"Freeze-up" (Solidification of salt absorbent)	At low capacity salts will crystallize and system become inoperative
No more of a problem than conventional systems. Steam use infinitesimal	Purging	Takes additional steam running up operating costs
Efficient at all loads. No more throttling problems than on compression systems	Throttling or Control	Only efficient at full load. Light capacity presents throttling problems
	Maintenance	
Vacuum problems overcome with internal modification		Vacuum maintenance requires additional personnel and special valves are required
No moving parts eliminates large or costly overhauls	Moving Parts	
Only on condensing water pumps in higher hp. Chill water auxiliaries same Admittedly additional hp for solution pumps, but not comparable to power cost and maintenance of entire compression system	Auxiliaries	Higher hp auxiliaries required; higher power bills, more maintenance

NOTE: Personalities are fictional, but viewpoints and arguments are from actual INDUSTRIAL REFRIGERATION interviews.

Neither Licensed Engineer Nor Operating Permit Needed

At this point Diz spotted the city inspector, Leon C. Burns, and felt that Lady Luck had finally smiled on him. In response to the instructor's question, Burns came up with the startling statement: "You speak of vapor absorption units. We have nothing in our ordinance pertaining to vapor absorption units due to the fact there is no refrigerant involved. The lithium bromide solution is an alkaline element or a salts which is dissolved in water. Therefore, we in the Engineering Division (Welfare and Safety Dept.) here treat it as such and have no jurisdiction over these units so far."

"Do you mean that there is no equipment permit required — like on a boiler or a compression plant?" asked Diz.

"That's right," interrupted Jack Turner, "no permit for the unit and no licensed operator, either!"

Anonymous remarks and comments popped up all over the room, mostly to do with "letting the janitor or office boy run it".

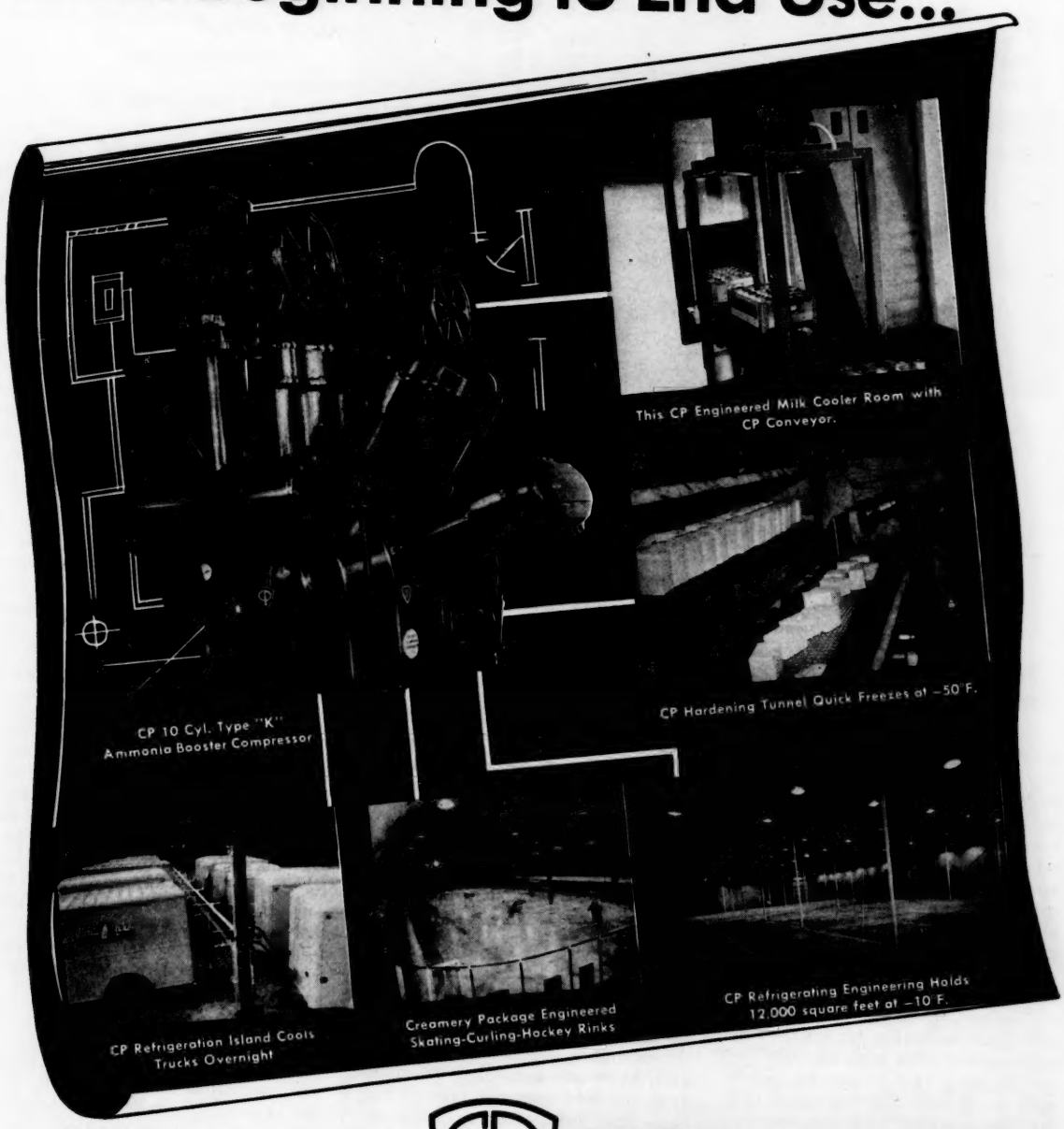
The president gaveled for order and Vern heatedly put in: "As you other operators well know, a number of possibilities are always present that could cause 'flooding' of this type machine, with consequent loss or damage to the lithium bromide solution which is very expensive and which runs into the thousands of dollars very quickly for each machine. On several occasions, situations have occurred suddenly which we happen to be fortunate enough to catch promptly and save our solution! Try running those machines with inexperienced men, and see how quick the Boss throws them (the units) or the chief out of the plant!"

Steam Demands Compared

Seeing that this subject could well lead into some long-winded and heated discussion among the practical participants, instructor Diz moved on to energy costs. On this topic he found three eager participants. In addition to Vern, Otto P. Krause, superintendent engineer of the City Hospital, and Cecil D. Hardy, chief operator of the State Public Office Building, wanted the floor at the same time. Diz gave Otto the nod.

"To begin with, in my opinion, an absorption machine should never be

From Beginning to End Use...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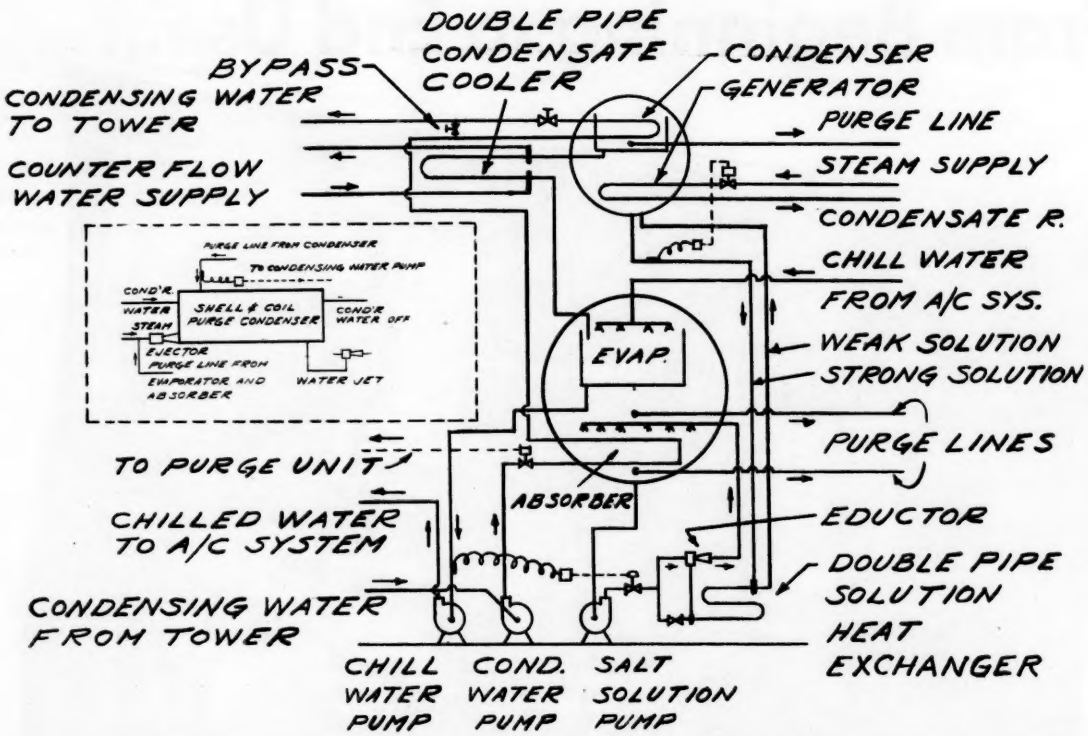


Fig. 1 — Sketch which Jack Turner made for Edwards City NAPRE Chapter as typical of his two hotel water vapor absorption systems. Inset drawing represents the purge unit. Characters like Jack are of course fictional, but dialogue in this story are direct quotes from interviews.

installed in a plant unless steam is to be used 365 days a year. For a building using steam, even as low as 11 lbs. pressure, the absorption machine is cheaper to run and maintain today. High pressure machines are no longer being built. Consequently, the new machines are cheaper to operate on the job than electric driven units, whether centrifugal or reciprocating, as exhaust steam can be used for operation.

"To my mind, the figures which you credit to Danahy are high. Steam consumption on a high pressure system is about 14.2 lbs per ton per hr with purge included, instead of 18.5 for the machine and 3.5 for the purge, as our esteemed Secretary guesses. The machines we are operating at the hospital are high pressure — one is a machine of 170 tons capacity, and the other 130 tons.

"It costs the hospital approximately a thousand dollars a month for 300 tons of refrigeration for 24 hours operation, 30 days of the month."

As Otto had apparently sounded a responsive chord, the instructor then called for comments from "Ceece", as engineer Hardy was known. Ceece said, "Steam consumption at my plant runs about 19 lbs. per ton per hour at full load, and 18½ lbs. at about 70 percent load with condensing water full flow at 3½ gpm per ton."

Vern's comments follow: "The cost of operation was also a factor which helped my management make its selection. However, it is a feeling with us now that the cost of operation is not as low as was put forth at the time.

Auxiliaries Raise Costs

"The actual cost of generating steam used per ton, as compared to the cost of electricity for an electric driven unit, is undoubtedly less. However, there are a number of auxiliaries required with this type of machine that bring the cost back up. For instance, each machine was furnished with a 15-hp solution pump although the original plans called for 3- to 5-hp pumps. We understand that the new machines of the same size are now furnished with a 3-hp solution pump and, as Danahy maintains so correctly, the machines require a purge system which uses additional steam."

Seeing that the discussion was now moving right along, Diz commented, "Vern, while you're on your feet, how about cutting us in on this problem of heat disposal; that is, what are the condensing water requirements?"

"As your table shows, the absorption machines use more condensing water per ton than, of course, an electric or steam drive 'safe refrigerant' machine. Whether Danahy or Scotty is right in the amount I cannot tell without referring to my records. But this water is used to cool gases at a higher temperature than other types of machines. As a result, we had a terrific problem with settling out of nonsolubles, etc., on the condenser tubes.

Water Treatment Problem

"We tried several kinds of chemical treatments, all to no avail. We had to acidize the tubes several times, and we were almost constantly having to brush out the tubes. We finally concocted, with some help from our NAPRE water chemist friends, the use of soft water make-up and chromate to prevent rusting, which brought on a dramatic change in the condition of the tubes and the action of the condenser water."

Diz found that the other two participants to the discussion readily agreed. "How about ease of operation?" asked Diz.

Vern, who was about to seat himself, took the initiative: "As far as the starting up of these machines, they are definitely not a push-but-

ton operation, and they require careful watching and close control during the initial stages of their start-up. Moreover, between the getting up of steam, etc., they require an amount of time that is greater than for an electrical or steam driven compression machine. In addition, in changing over from heating to air cooling, which we often do on the same day, quite some time is required.

Trained Personnel Unavailable

"Also, from a management standpoint is the question of operation. Since these machines are entirely different in principle from an ordinary electric reciprocal or centrifugal type machine, or even a steam driven centrifugal machine, they require much longer periods to break in operating engineers and the flexibility in getting temporary or permanent replacements in case of sickness, etc., is not at hand.

"In other words, it is the feeling of my management that if they had to do the same thing over again that they did some four or five years ago, they would have put in an electric driven machine even though it might have meant a little more operating cost, as such machines are easier to obtain operating personnel for, and are easier to start up, etc."

"Ceece, you mentioned you had three units," said Diz. "Have you any Fall and Spring problems? How long does it take you to get on the line?"

Start-Up Time Compared

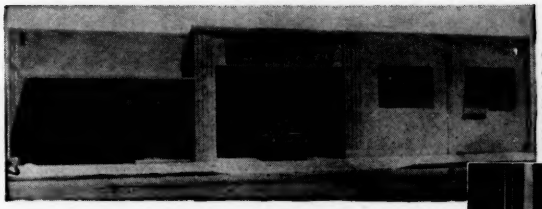
"During the Fall and Spring season where heat is needed one part of the day and cooling another part," said Ceece, "there is no problem if you have a dual system such as mine. There are days during the Fall and Spring that it is necessary to run heat and cooling at the same time.

"The three units I refer to are 200-tons each and operate on 15 lbs. steam from low pressure, gas fired boilers. It requires 30 to 40 minutes to put the plant in operation, including the time required to raise steam. When the plant is once started up, it operates fully automatic".

At this point Otto got his two cents in with the remark, "The absorption machines can be put on the line and water temperature can be had in 30 minutes, providing the machines are all purged down and are pulling the vacuum."

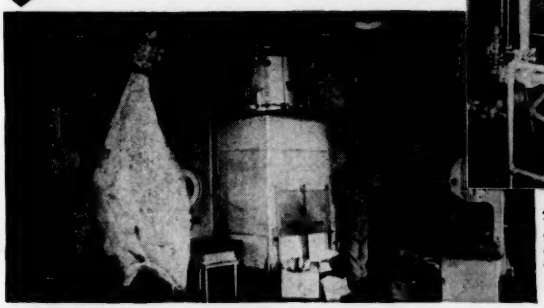
Multiple Unit Operation

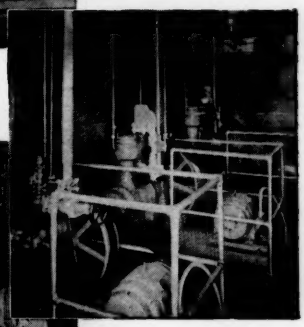
"That brings us to multiple unit operation on a single system" commented the instructor. "Otto, you have two machines of different ton-



View of the new Long Beach Seafoods Company plant in Long Beach, California. It imports a great quantity of seafood products from all over the world.

This new plant has three holding rooms kept at 0° F. and one freezer room with temperatures from —40° F. to —60° F. for the quick freezing of local fresh fish. Shown below is the room locating a Vilter Polarflake unit.





View showing the two Vilter vertical ammonia compressors and one vertical ammonia booster compressor.

Q. Why is Vilter refrigeration so popular with this new seafood plant?

A. because Vilter equipment provides outstanding performance and costs less to own*

Long Beach Seafoods Company, one of the West's progressive distributors and processors of seafoods, has in the past three years converted from 90% fresh and 10% frozen fish sales to 90% frozen and 10% fresh fish business. Because of this, it was decided to build an entirely new plant, using only the highest quality equipment. Previous experience of the owner with Vilter's excellent service record in his shrimp freezing plant influenced his choice of Vilter for his new plant. This customer is very pleased with Vilter equipment again giving continuous trouble-free service.

The heart of this refrigeration system is three Vilter two-cylinder ammonia compressors—two high pressure and one booster. For the ice maker, a Vilter Polarflake unit was naturally chosen to produce an ice assuring rapid chilling for the freshly caught fish. Polarflakes are cold, crisp flakes, which expose maximum chilling area to the fish and won't bruise or puncture them.

Vilter is your guarantee of refrigeration in the fish and meat industries that you can count on. Let Vilter engineer your next refrigeration job.

This equipment was sold by Vilter's California distributor, Refrigeration Machinery Corp. of Wilmington, California.

* Savings in low first cost are not the complete answer when considering the installation of refrigeration equipment. But savings in terms of years of extra service, reliable performance and minimum maintenance—that's where Vilter excels in low-cost ownership.

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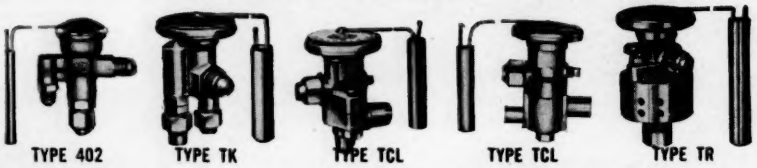


TYPE 402 with pressure limiting feature

TYPE TK "3 valves in 1"

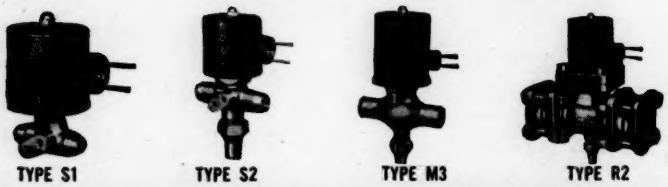
TYPE TCL with angle connections

TYPE TCL with straight-thru connections

TYPE TR Multi-Outlet

For automatic control of liquid refrigerant on all types of refrigeration and air conditioning systems. Capacities: from fractional tonnage to 220 tons Freon-12, 350 tons Freon-22; selective charges. Low temperature valves for −40°F to −100°F.

SOLENOID VALVES



TYPE S1

TYPE S2

TYPE M3

TYPE R2

For all types of service. For liquid: Freon-12 up to 75 tons; 110 tons Freon-22. For suction: Freon-12 up to 10 tons; 15 tons Freon-22. For brine, water, steam, hot gas discharge, air and oil.

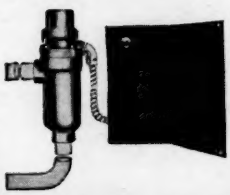
FLOAT VALVES AND SWITCHES

TYPE HK

high pressure float valve. Up to 5 tons Freon-12, 8 tons Freon-22 and 20 tons Ammonia.

TYPE J5

electric float switch. For Freon, Methyl Chloride, Ammonia and other non-corrosive liquids having a specific gravity of .6 or more. Up to 230 volts AC or DC.



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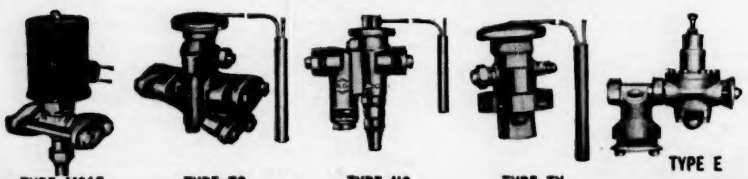
AMMONIA CONTROLS



TYPE M91F

TYPE TG

TYPE UG

TYPE TX

TYPE E with strainer

Solenoid Liquid Valves—up to 172 tons. Solenoid Suction Valves—up to 28 tons. Thermo Expansion Valves—from fractional tonnage to 125 tons. Automatic Expansion Valves—from fractional tonnage to 60 tons.

SUCTION LINE CONTROLS

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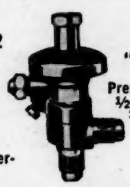
For all refrigerants, with connection sizes up to 6"

TYPES 771-772 SUCTION PRESSURE REGULATORS

(Hold-Back Valves)

Prevent motor overload. Freon-12, Freon-22.



TYPE 760 "EVAPOTROL"

Pressure regulator—½ ton, Freon-12—¾ ton, Methyl Chloride.

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nage. Do you operate them on the same cooling water system?"

Otto exploded: "It is impossible to tie those two machines in together; the 170 ton machine has 3400 lbs. of steam per hour available at 60 lbs. psig and the 130 ton machine has 2460 lbs. of steam per hour available at 60 lbs. psig. Then too, gpm's of chilled water and condenser water is different.

"If these machines were of the same tonnage capacity they could be tied in together and operate as one machine; on the other hand when a smaller demand load is required, only one machine would have to function."

All ears at the chapter meeting had been tuned in on the comments from the participants and Diz was quick to realize that the discussion had developed into a most interesting one. Since Otto had apparently finished his comments, the instructor moved right on to the operating characteristics as listed on his blackboard illustration.

"Otto, Danahy had argued that he has knowledge of vacuum leaks, solution solidifying, and purging problems. You have some of the earlier units of these machines installed in your plant, apparently. Have you had these difficulties that our Secretary anticipates in the plant that his employers are going to purchase?" Of course, this instilled a little humor and it appeared for a moment that Danahy was going to get an oar into the discussion. However, Otto was quicker.

Solution "Freeze-Up"

"Yes, my machines have 'frozen up' as we say. Even though I have made some slight changes, that salt solution will continue to solidify if not operated right. But some literature I received recently (I also wrote in when I saw the INDUSTRIAL REFRIGERATION item) says, "the new type package unit cannot solidify; nor can it be hurt by loss of vacuum; nor can the charge be lost out of the purge unit, since the purge unit has a sealed system."

"From the operating end, we feel at our place that we now have the machines, and ourselves, in shape, so that we have good operation", Vern came in without further invitation. "To arrive at this state, however, we have been through many trials and tribulations.

"The machines were first installed some four or more years ago, and from the outset, we had a lot of trouble. Some of these troubles have been overcome by the manufacturer themselves, who have made changes in the machine, particularly with respect to the purge system, dew point, bottle, etc. The rest of the troubles, consisting mainly of condenser water problems have been overcome by us.

Fig. 2 — View of the 200-absorption air conditioning plant installed in Jack Turner's plant in 1951. Condenser-generator is the large vessel at top, evaporator-absorber beneath it, double pipe condensate cooler below that, and the condensing water pump in foreground.

"We also had our full share of 'freeze up' of the solution and other mishaps, before we mastered the operation of the machine, along with the help of the changes that were made.

"Some of the other disadvantages that are apparently inherent with this type of machine should be mentioned. For instance, due to the fact that the machine operates under a vacuum, which is directly imposed on the chill water in circulation, there is a vacuum at all of the fan units below the machinery until a point is reached where positive pressure returns. In our case, this means down to the third floor.

Special Valves Required To Prevent Vacuum Leaks

"Consequently, at all of these units above the third floor, we have to use a diaphragm type of valve, such as the Hills-McCanna valve. Since we use our system for both cooling and heating and circulate water with quick changes in temperature from day to day, from a range of 45 to 120 F or higher, there is a great deal of expansion and contraction in these valves. This means that after a couple of years, all the covering must be taken off these valves and the bonnet must be tightened or the diaphragms changed, in order to prevent leaking.

"Also, our chilled water pumps had to be installed on the third floor in order to use the ordinary type of pump, which means going down to the third floor to start these pumps in the morning."

Hardy was not to be left behind in the discussion now. "Danahy based his argument against absorption plants on his experience with the aqua NH_3 machine," stated Ceece. "I agree that the old time absorption machines operating on aqua ammonia and water were not adaptable to rapidly changing loads.

Handles Varying Loads Well

"The absorption refrigerating machines of today operating on lithium bromide as an absorbent, and water as a refrigerant, are quite different in many ways from the old type absorption machines. I find them as adaptable to rapidly changing loads as many of the other types. The load change is controlled by the temperature of the chill water thermostat which is set at the chilled water temperature you want. When it becomes satisfied it operates the condensing water thermostat which throttles the condensing water.

"The condensing water being throttled, you condense less of the vapor boiled off from the generator which causes the lithium bromide returning to the absorber to be weaker and have less power to absorb water vapors; less vapor being ab-

sorbed in the evaporator causes the machine to begin throttling back. The steam supply is also reduced by less condensation.

"The new type absorption machine operates under 29.7-in. of vacuum, and more if you can get it. They must be kept tight. A very small leak can cause the loss of capacity and solidification. I find that it is not difficult to keep them tight.

"Lithium bromide does not form crystals or deposit on the inside of pipes. When it becomes concentrated it will solidify or turn back to solid salt. This can happen only in faulty operation."

"Well," said instructor Diz, "since Ceece has introduced the subject of controls or throttling, as he puts it, what are your experiences, Vern?"

The Department store chief engineer supplied "Naturally, there are some advantages to the machine—one of the advantages being a direct contradiction to Danahy's contention that they are inflexible. These machines seem to be very adaptable to changing loads, and regulate themselves very well automatically all the way from full load condition down to virtually no load condition, promptly and without any visible lack of nice control."

Otto added, "On load changes, I find our absorption machines can handle from one-third to a full load without any trouble."

"How about maintenance, Otto?"

Maintenance Comparisons

Otto: "Well, Danahy compares maintenance with a gas engine driven compressor. I have much experience on internal combustion. In my opinion, the real maintenance cost is about half what it would cost to overhaul a natural gas engine of that horsepower."

Ceece added to Otto's remarks: "For maintenance of absorption plants, not having actual figures on this plant or any of the other types at hand, I would say that it will run near the same as equivalent tonnage of some of the other types of compression equipment."

"Also, from a maintenance standpoint," Vern chimed in, "the lack of moving parts make them somewhat easy to maintain. As far as the vacuum is concerned, once you have the machine tight, it is no particular trouble to retain and maintain the vacuum. That is our only real maintenance headache."

"Let's wind this up now," said Diz. "Any comments on auxiliaries?

"Well", from Vern again, "these units require one type of auxiliary not found in a compression system—the solution pumps. On my 250-ton units each, you will find a supply pump of 7½-hp and a return pump of 7½-hp for that 15-hp total each. Also, these machines use more condenser water per ton, as indicated, and consequently require larger tower, large condenser water pumps and the use of more water and chemicals than electric machines."

"Why more water?" from an unidentified member.

"The reason we use more water" countered Otto, "is because we must blend with the water exchanged to hold a constant condenser water temperature to keep the generator load from being too much of a quick exchange."

"Understand"? asked Diz.

"The boys understand Otto," interrupted Art Peterson, the chapter prexy, "even though he does double talk or get to things by the backdoor. "Now we've run well overtime, Diz. How about summing up in three minutes?"

"I regret I cannot comment on these absorption machine claims of Scotty's or Danahy's as none of the machines installed in this area are of the new improved type. My last experience with these machines was about 1949, and I understand considerable changes have been made since then.

Five Considerations For Judging Vapor Plants

"However, the following may help sum up some of the comments made tonight:

"(1.) There must be no leaks. A slight leak will reduce capacity and increase starting time. A larger leak will stop refrigeration. Of course, we must remember that there should be no leaks in any refrigeration system. A leak in a centrifugal machine operating on a vacuum may not only stop efficient refrigeration, but it also may cause extensive damage to the machine if not corrected.

"(2.) There has been no difficulty due to crystallization of lithium bromide once controls are properly set and operators properly trained.

"(3.) Maintenance costs are widely variable from one plant to another, due to water conditions and the varying ability of operators. I suggest contract certified maintenance figures be used for cost comparison.

"(4.) Any properly designed plant, regardless of the type of refrigeration employed, can heat one part of a building and cool another.

"(5.) Each job must be analyzed to determine whether the absorption system or some other system is more economical to own and operate.

"I've just noticed a distinguished member who has had considerable experience with these installations. He's involved everytime a unit goes in. Perhaps he can sum-up better than I. He has his pencil out and apparently made a fist full of notes."

"Syd", Diz addressed Syd Meadows, power sales representative of the Public Light & Power Co. "Sorry we can't give more than a minute now — wish I had seen you earlier — but, can you give us your firm's experience in a nutshell? You sell all three — electric, gas and steam energy."

"Glad it's only a minute I have to put in, Diz. I might be giving away company secrets if I really got wound up. Do want to acknowledge that with Danahy's unusually quiet help, a lot of information came out tonight. Things I didn't know, but which will come in handy. Here's my pitch:

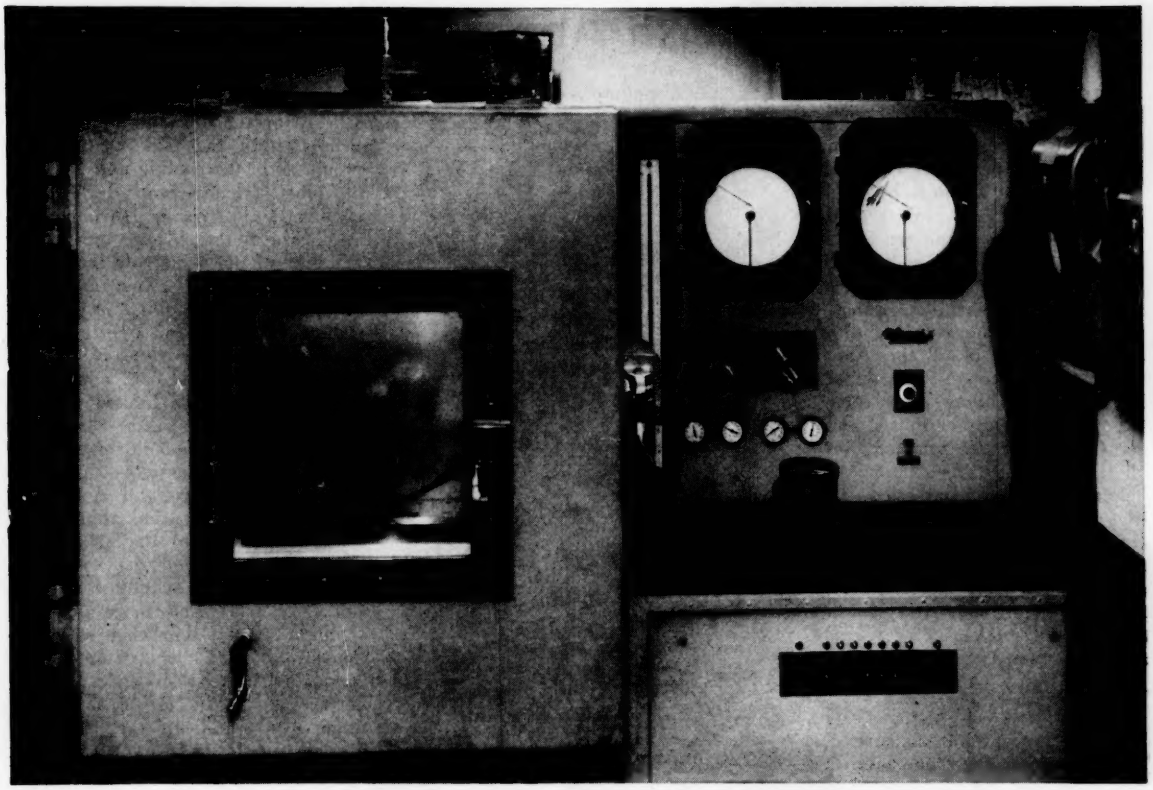
"Annual operating costs of steam absorption and electric drive centrifugal refrigerating systems have been compared for a number of installations. When all the factors which make up operating costs are considered, they show that: (1) the variable costs which include boiler fuel and electricity are favorable to electric drive; (2) the overhead costs, consisting of attendance labor and maintenance are less for electric equipment and (3) the fixed charges on the capital investment made up of depreciation, interest, insurance and taxes are also favorable to electric drive."

"Hooray! That's my boy!" came from the explosive Danahy whose duties had kept him corked-up.

"You're out of order" came from President Peterson, with a crashing rap of the gavel. "Thanks Diz, Syd, and all the rest of you. Scotty, see our program chairman and let's arrange a spot for a discussion of the improvements to this machine. Might even make it a field trip to a new installation soon. Danahy, let's have the minutes of the last meeting—we got another very good subject and speaker waiting."

"Bet a million that it would take a building big as a stockhouse, and another boiler plant for one of them things to do our wort cooling," started Danahy—

Crash, went Art's gavel. "You haven't got a million, you're prejudiced, and you're about to be fired as Secretary", roared the prexy. "Read those minutes". Which is what Danahy attempted to do amid the laughs provoked by the mild-mannered Peterson's irritation at the Secretary's wanting to have the last word.



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In the test chamber at top, equipment can be subjected to pressures as low as those met at 80,000 feet, to temperatures from minus 100° to +250°F. and to humidities from 18% to 95% within temperatures from 50° to 150°F. The Low Temperature Chamber, (right) located directly opposite the one described above, can go as low as −100°F. Their close proximity affords convenient thermal-shock test facilities.

These "Dive and Climb labs", made by Conrad, Inc., Holland, Michigan, are equipped with Taylor Instruments. Above are a Taylor Pressure Controller with a split scale the equivalent of 100,000 ft. and 30" of mercury, and a Taylor Electronic Contact Wet-and-Dry Bulb Controller. On the Low Temperature Chamber at right is another Electronic Temperature Controller.

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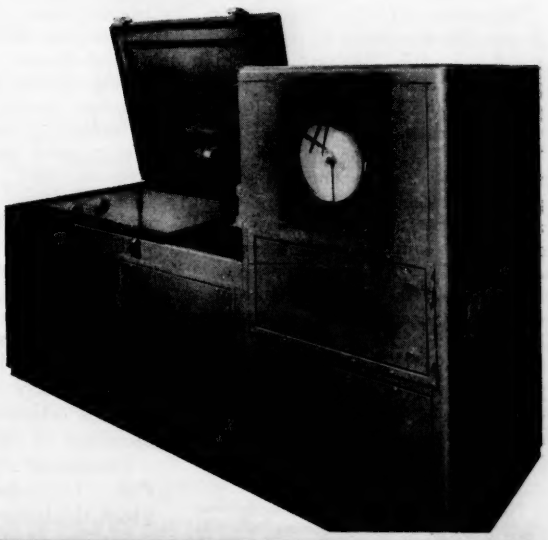

Taylor Instruments **MEAN ACCURACY FIRST**

Brine Cooling of Fish Aboard a Fishing Vessel

JOSEPH W. SLAVIN

Fishery Technological Laboratory
U.S. Fish & Wildlife Service
East Boston, Mass.

THE design or the selection of equipment for a brine-cooling or a freezing system to be used on a particular fishing vessel is based on (1) the amount of fish to be handled, (2) the freezing or cooling time required, (3) the brine temperatures desired, (4) the size of the vessel, and (5) certain factors peculiar to the particular fishery in which the vessel is to be engaged.

The coverage of all these factors is beyond the scope of this paper. A brief analysis, however, of some of the more important equipment-design considerations that are common to all brine-cooling systems may be helpful to those contemplating designing or installing a brine-cooling or freezing system. The following will therefore be concerned with a discussion of the more important factors that should be considered in regard to (1) brine tanks, (2) evaporator, and (3) refrigeration machines.

Brine-Tanks

In order to permit effective cooling of the fish, the brine tank must be so designed that an adequate, constantly renewed film of cold brine is maintained in intimate contact with the entire surface of the fish. To accomplish this, it is necessary that the ratio of brine to fish be sufficiently large to prevent "packing" of the fish and that a system be used employing (1) movement of the fish through the brine or (2) circulation of the brine around the fish.

Movement of Fish Through the Brine: The movement of fish through the brine while they are held in a perforated cylindrical basket, as employed on the Fish and Wildlife Service's experimental freezing vessel "Delaware" (Magnusson and Hartshorne 1952), offers one of the most positive methods of insuring rapid and uniform cooling. A perforated cylindrical container with an allowance of 20 pounds of fish per cubic foot, moving through the brine at a speed of 30 feet per minute, presents ideal cooling conditions. An allowance of more than 20 pounds of fish per cubic foot results in "packing", thereby reducing the cooling or freezing rate considerably. Movement of the fish through the brine at speeds of less than 30 feet per minute may result in slower cooling of some of the fish, whereas movement at speeds greater than 30 feet per minute will not increase the heat transfer between the fish and the brine sufficiently to warrant the extra power required to drive the basket mechanism. A brine-tank capacity of about 7 pounds of brine for each pound of fish contained in the cylindrical baskets will prevent an excessive rise of the brine temperature when the fish are initially cooled.

A method of brine cooling or freezing such as that described above for cooling and freezing groundfish on the trawler "*Delaware*" has many other applications. Its use in cooling and freezing shrimp would prevent the shrimp from "fusing together" when frozen in a sodium chloride solution. Other applications would be the cooling or freezing of herring, mackerel, salmon, and other fish that do not exceed 6 inches in thickness. The longer cooling time required by fish over 6 inches thick, because of the limited transfer of heat due to the increased thickness, does not warrant the rapid movement between brine and fish that is necessary for cooling or freezing smaller fish. The extra space required by the baskets and the driving mechanism together with the additional power required by the mechanism for the basket drive, would be decidedly disadvantageous if this system were used for cooling and freezing thick fish, such as large tuna. The time required for loading and unloading the baskets is also a factor which must be given consideration. This system, while being ideal for low temperature cooling of fish which is to be removed, after reaching the desired temperature, to a refrigerated hold, does not seem to offer many advantages for cooling and subsequent storage of large quantities of fish in the brine tank.

Circulation of Brine Around the Fish: In brine-cooling tanks in which the brine is circulated, an attempt is made to maintain a continuous flow of cold brine around the fish (1) by using a brine agitator in the brine tank, as in the cooling and freezing of shrimp (Mingledorff 1954), or (2) by circulating the brine within the tank by a brine pump, as in the cooling and freezing of tuna (Hendrickson 1950). In cooling and freezing shrimp, the small size of the shrimp, the proper agitation of the brine, and the use of a low-temperature salt-sugar brine solution permits rapid and uniform cooling. In cooling and freezing tuna, however, the large ratio of fish to tank volume (about 50 pounds per cubic foot) and the limited circulation of the brine within the brine tank might well result in slower cooling, causing increased salt penetration into some of the fish. A smaller ratio of fish to brine-tank volume, increased agitation of the brine, and close control of brine density to reduce the buoyancy of the fish will result in quicker and more uniform cooling, thereby somewhat reducing the rate of salt penetration. Tests conducted at a Fish and Wildlife Service laboratory (Holston and Pottinger 1954) indicate that this rate of salt penetration can be considerably reduced by the use of lower brine temperatures.

Evaporators

The refrigeration effect necessary to cool the brine to the required temperature can be provided (1) by using refrigerated surfaces in the brine tank or (2) by circulating the brine through a brine cooler located in the refrigeration room.

Refrigerated Surfaces in the Brine Tank: In most brine-cooling and freezing installations aboard fishing vessels, bare pipe coils are used to furnish the necessary cooling surface. The size of the particular coil needed depends largely on the particular refrigerant used. If ammonia is used, oil return to the compressor is not a major problem. If, however, Freon 12 or Freon 22 is used, the coils should be sized properly in order to obtain a high enough velocity to insure satisfactory oil return. Bare pipe coils 1¼ inch in diameter, when used in a direct-expansion ammonia system, offer a heat-transfer rate ("U" factor) of approximately 15 Btu/hr. sq. ft./F. if immersed in an agitated brine solution. High-capacity brine pumps circulating the brine within the tank directly over the coils will increase the "U" factor considerably. A flooded-coil system in lieu of a direct-expansion system will further increase this heat-transfer rate.

This paper was presented at an international meeting of fish processing technologists organized by the Food and Agricultural Organization of the United Nations Interim Committee on Fish Handling and Processing, held at Rotterdam, The Netherlands, June 25-29, 1956.

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In some installations, bare-pipe cooling coils are located directly against the sides of the brine tank. A space of 2 or 3 inches between the sides of the tank and coil would permit brine circulation around the entire periphery of the coil, resulting in slightly greater heat transfer between the coils and the brine.

Bare pipe coils, finned pipe coils, or refrigerated plates, located in a separate portion of the brine tank and arranged so as to permit the circulation of brine over the coils at a high velocity, offer the advantage of an increased "U" factor, resulting in a reduction in the area of coil surface required. In an installation in which the refrigerated surfaces are located in a separate compartment in the brine tank, or in any other installation in which the fish do not come in contact with the coil surface, the use (1) of finned pipe coils with a fin spacing of not less than 1 inch or (2) of refrigerated plates should be considered because of the high heat transfer afforded per linear foot.

The formation of "slush ice" on the cooling coils, which is due to lowering of the temperature of the film of brine surrounding the cooling coils below that of its freezing point, will reduce the coil efficiency considerably. This formation of slush ice can be eliminated (1) by maintaining a close differential between the coil temperature and the freezing temperature and the freezing temperature of the brine (not more than 10 F) and (2) by insuring positive brine circulation around the entire surface area of the coils.

Circulation of Brine

Brine Coolers: Circulation of the brine in the cooling tank, through a brine cooler, offers quick, efficient cooling at high evaporative temperatures. A flooded-type brine cooler, which offers a high heat-transfer rate, has certain disadvantages peculiar to marine operation, the principal ones of which are (1) danger of the brine freezing and rupturing the tubes because of lack of circulation caused by the accumulation of foreign materials in the tubes or by brine-pump failure; (2) decreased performance due to difficulty in maintaining proper ammonia level because of excessive rolling and pitching of the vessel; and (3) deterioration of tubes due to corrosive action of the brine. In existing installation, these disadvantages can be reduced by use of (1) an adequate brine-straining system, (2) automatic controls to isolate the cooler in event of failure of the brine pump, (3) a salt-sugar brine with a low freezing point (Holston 1952), (4) a proportioning-type level control, (5) equipment having 20-percent larger capacity than required, and (6) heavy-gauge wrought-iron tubes, galvanized on the inside.

The use of a direct-expansion-type brine cooler should be seriously considered in brine-cooling applications. The disadvantages of increased space and higher initial cost over that of the flooded-type cooler are offset by (1) the reduction in danger due to brine freezing, (2) the absence of troublesome level controls, and (3) the protection afforded against corrosion. (This is especially true of a Freon-type cooler where copper-alloy tubes are used.)

There are two principal types of refrigeration machines: the absorption machine, and the compression machine.

Absorption Machine

The Absorption Machine: The absorption machine, which operates on steam from the boiler of the ship, offers a low initial cost, an economy of operation at low evaporative temperatures, and a minimum of moving parts. Also, its satisfactory operation at variable loads and evaporative temperatures makes possible the utilization of one machine for variable-capacity operation in lieu of two or more compressors. A problem in existing absorption machines has been the low performance and difficult operation, owing to the lack of suitable automatic controls. To obtain high performance and ease of operation, the following should be considered:

1—The maintenance of the proper liquid level in the generator by use of a proportioning-type level control.

2—The proper proportioning of the steam flow to suit the load condition by use of a steam-regulator valve that is actuated by the absorber suction pressure.

3—The proper proportioning of the aqua flow (from absorber to generator) to suit load conditions, so that a constant ratio of about 8 pounds of aqua for each pound of ammonia flowing through the evaporator can be maintained at all times. This proportioning can be done by means of a rheostat on the aqua-pump motor, operated by an air-supply proportioning type relay that is actuated by the float mechanism in the brine cooler or accumulator.

4—The prevention against freezing of the brine in the brine cooler (flooded type) by solenoid valves, that are located on the liquid line and the vapor line and that are activated by a brine thermostat and a pressure switch on the brine-pump discharge line.

5—The control of the head pressure by a temperature-control valve installed in the discharge line of the circulating pump.

6—The use of suitable liquid-level sight glasses in the generator, absorber, receiver, and brine cooler.

7—The use of thermometers, pressure gauges, and suitable alarms to warn personnel if the system is not operating properly.

In order to obtain continual satisfactory operation of the controls mentioned above, the operating engineers would have to be instructed in the proper servicing and operating techniques, in much the same manner as with any other new piece of mechanical equipment.

The absorption machine should be located in a separate vented compartment that is provided with a water-sprinkler system (American Bureau of Shipping rules, 1955, Section 38, paragraph 5b.) The space requirement for absorption equipment of about 24 cubic feet per ton of refrigeration for a 30-ton machine and brine coolers seems high. Such a space requirement, however, should be compared with the space required by the compressors that would be used to achieve satisfactory operation at the minimum and maximum loads involved.

Waste-Heat Boiler

A waste-heat boiler, utilizing exhaust gases from the main propulsion diesel engine, equipped with an automatic fuel system for maintaining a constant steam output at variable engine speeds would provide a cheap supply of steam to the absorption refrigeration unit. This possibility should be considered in selecting an absorption system for a new vessel that is to be equipped for brine cooling or freezing fish.

The Compression Machine: Compression machines provide dependable, economical refrigeration at all evaporative temperatures. The wide variety of refrigerants that can be used, together with the low space requirements and versatility of drive, makes the compression machine well suited for marine operation.

If ammonia is used as the refrigerant, the compressor should be located in a separate, well-ventilated compartment, with a sprinkler system, in order to minimize the danger to personnel in event of ammonia leakage. Even though ammonia compressors furnish a supply of efficient

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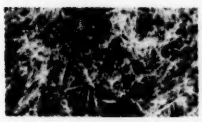

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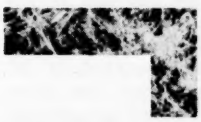

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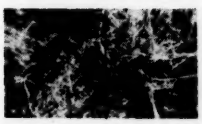

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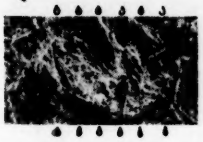

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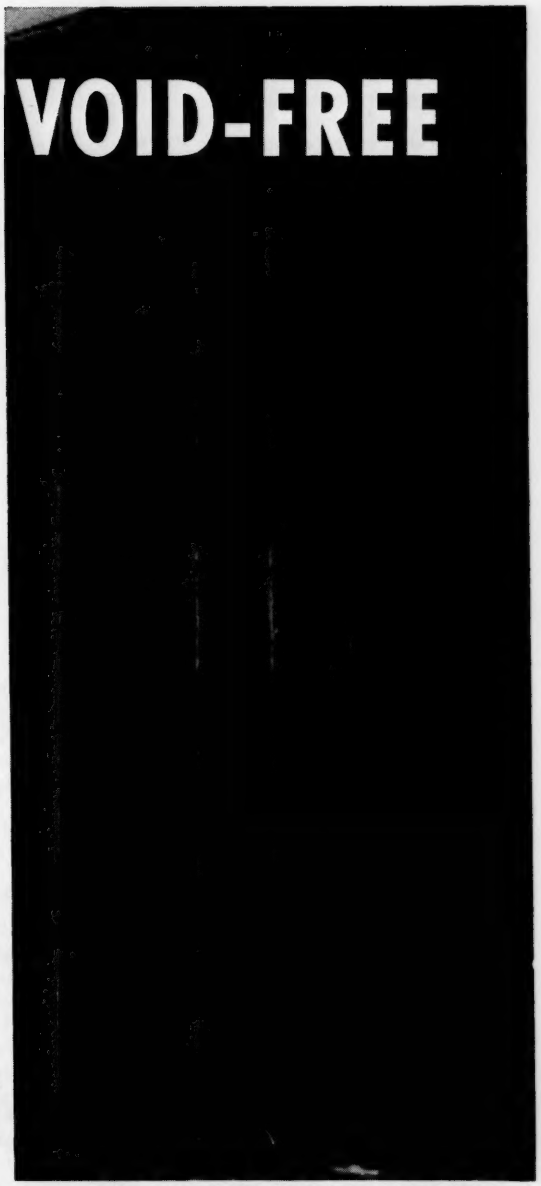

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refrigerant, with little or no oil-return problems, their use is somewhat limited on small fishing vessels, where space is at a premium.

Freon-12 or Freon-22 compressors can be located in the engine room of the vessel, thereby making possible the utilization of excess space. In designing a Freon compression system, the designer must take care to properly size the evaporators and the suction lines in order to insure satisfactory oil return. Suitable oil separators should also be used.

A compression machine on fishing vessels can be driven by (1) a direct current motor, (2) a diesel engine coupled to the compressor by a clutch or a flexible coupling, or (3) a connection off the main engine.

Small Brine Cooling

For small brine-cooling installations, operation of the compressor by a separate diesel engine or by a connection off the main engine provides satisfactory operation. In larger installations, the use of a diesel-eletric generating unit and direct-current motors is favored because of the small amout of space used and the versatility of operation provided.

Capacity control for variable-load operation is obtained on many compressors by using a suitable unloading device or by reducing the speed of the unit. In general, however, this capacity reduction is limited to 50 percent of the maximum compressor capacity. Therefore, on brine-cooling and freezing systems, where loads less than 50 percent of the maximum capacity are to be experienced, two or more compressors must be connected in parallel, resulting in increased space requirements per ton of refrigeration.

Summary

1—The ratio of brine to fish must be large enough to permit adequate circulation of the brine around the fish during cooling.

2—The movement of fish in a perforated cylindrical basket through the brine offers a positive method of insuring that the cooling will be rapid and uniform.

3—A slow rate of brine circulation within the brine tank will result in slow cooling and may increase the rate of salt penetration into the fish.

4—Refrigerated surfaces should be installed properly in the brine tank in order to obtain maximum transfer of heat.

5—The present difficulties in flooded brine coolers can be corrected by (1) the use of proper controls and (2) the taking of measures to prevent the failure.

6—The absorption machine, if equipped with suitable automatic controls, offers variable-capacity operation at a low initial cost.

7—The compression machine, although offering economy of operation and versatility of drive, has narrow load limitations.

Air Conditioning and Refrigeration Exposition At Chicago International Amphitheatre

CHICAGO'S International Amphitheatre, which in August housed the Democratic national convention, has been selected as the site for the 10th Exposition of the Air-Conditioning and Refrigeration Industry, it was announced by Geo. S. Jones, Jr., managing director of the Air-Conditioning and Refrigeration Institute, sponsor of the biennial exposition.

Decision to hold the big 1957 show at the Chicago Amphitheatre followed a meeting in Chicago of ARI'S Exposition Committee under the chairmanship of Rollin H. Israel of Virginia Smelting Company, West Norfolk, Virginia. Dates for the exposition are November 18, 19, 20 and 21, 1957.

Tentative plans to hold the show at Chicago's Navy Pier on the lake front were cancelled following the show committee meeting, at which the opinion was expressed that the Amphitheatre offers larger facilities and is better adapted to the needs of an exhibit the size of the ARI show.

Huge Space Available

Factors in the decision included the greater load-bearing capacity of the floors of the Amphitheatre, and better arrangement of space to permit wider flexibility in booth sizes and shapes. The Amphitheatre offers an unbroken rectangular space 300 by 600 feet in area, has large truck entrances on three sides which permit trucking of exhibit material direct to booth locations on the floor, and has a railway siding going directly into the building.

Plans have been set on foot for other phases of the exposition, to be worked out by Exposition Director George E. Mills in the 14 months before the show, Mr. Jones said.

Pointing to the growth of the air-conditioning and refrigeration industry to its present position among "the great industries of the country," Mr. Israel said that the biennial expositions of ARI have marched hand-in-hand with this growth, and now "rank among the first 10 trade shows in the country — in size, in scope and in importance. "The ARI expositions have truly become 'the market place of the industry,'" he continued.

"More than 250 companies exhibited at the last exposition in Atlantic City. This list includes the leaders in the industry who have found through actual experience that in their over-all sales planning, a well-planned exhibit at an ARI exposition is one of the increasing sales.

"We fully expect the 1957 exposition in Chicago to surpass in size and importance all previous shows and to reflect to the credit of the industry."

Frozen Juice Stocks Drop

THE July net reduction of five million gallons in stocks of orange concentrate was one million more than average but one million less than July last year, the Department of Agriculture reports.

Current stocks amounted to 37 million gallons or 17 per cent more than a year earlier and 44 per cent above average.

Warehouse stocks of frozen fruits were up 82 million pounds from June 30 to total 451 million pounds, the largest ever reached for July 31, and only 26 million pounds under the record Sept. 30, 1956, stocks.

The near all-time record is accounted for by the largest strawberry carry-over on record and the largest net input in the three months following the seasonal low. Since April 30, frozen strawberry holdings showed a net gain of 178 million pounds which brought warehouse stocks to the record 243 million pounds by July 31.

Frozen vegetable increases during July totaled 93 million pounds which compare with the average of 65 million and the July, 1955, net increase of 64 million. Seasonal gains, particularly frozen peas, raised national stocks to 574 million pounds, a record for July 31. The sharp and significant increase in frozen pea holdings sent stocks from 127 million pounds on June 30 to 246 million on July 31. Stocks already exceed by 15 million pounds the record stocks of Aug. 31, 1953.

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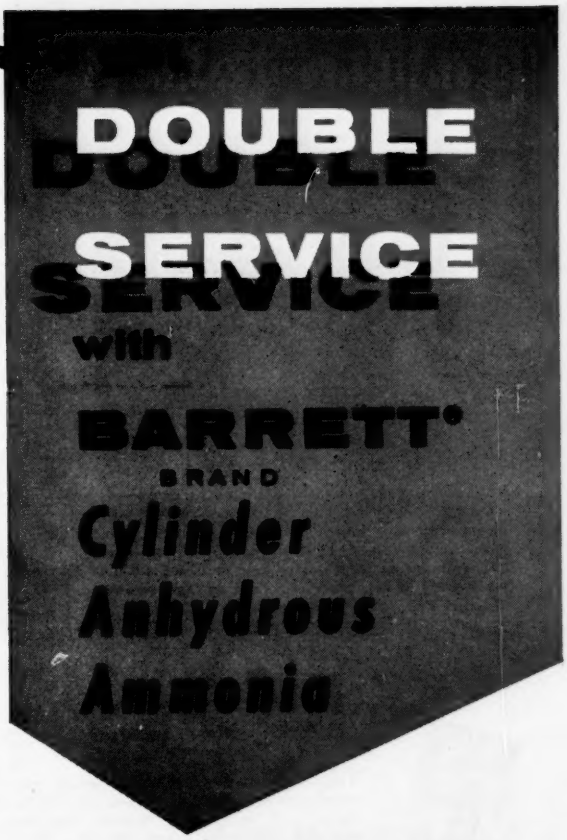

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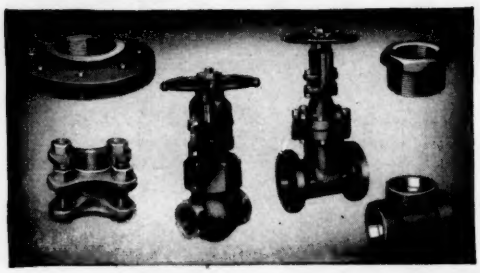


DROP FORGED VALVES AND FITTINGS FOR TOUGHNESS AND TROUBLE-FREE SERVICE

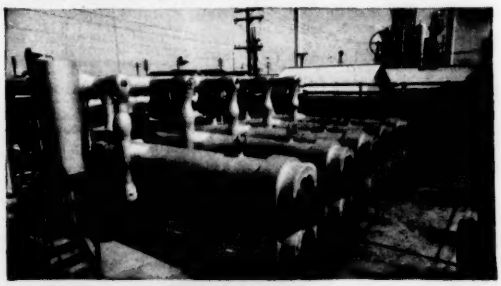
Drop forged from carbon and alloy steels, Vogt valves, fittings and flanges will safely handle liquids and gases at high pressures and high temperatures in power plants, chemical plants, petroleum refineries, etc. The complete line includes flanged, screwed and socket weld end globe, gate and check valves—ells, tees, and crosses—couplings—bushings—plugs—unions—flanges and flange unions—and welding heads.

MODERN STEAM GENERATORS

Vogt steam generators are designed to give maximum rating in a minimum of space, with high efficiency and low maintenance expense. Bent tube types and straight tube, forged steel sectional header types to burn solid, liquid or gaseous fuels meet every power, process or heating requirement.

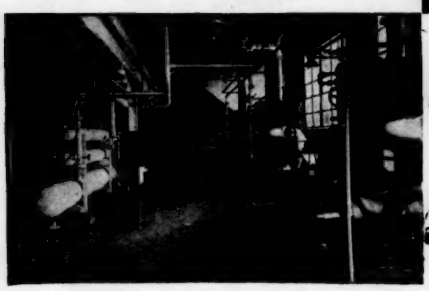
PROCESS EQUIPMENT FOR EVERY SERVICE

Vogt constructs process equipment in wide variety to all Codes. Stills and towers, oil chillers, crystallizers, heat exchangers, molding machines, etc., serve in the manufacture of oils, greases, 100 octane gasoline, synthetic rubber, chemicals and related products around the world.



SPECIAL MATERIALS COMBAT CORROSION AND PRODUCT CONTAMINATION

Our modern shops produce a wide variety of equipment from special metals and alloys to fight corrosion and product discoloration or contamination. Fabrication procedures insure that corrosion resistant properties of welds will match that of the materials used to construct the equipment.



Vogt

PRODUCTS

FOR REFINERIES, CHEMICAL PLANTS POWER PLANTS AND PROCESS INDUSTRIES

Write Dept. 24-RIIR for catalogs

HENRY VOGT MACHINE CO.
LOUISVILLE 10, KY.

SALES OFFICES: New York, Philadelphia, Chicago, Cleveland, St. Louis, Charleston, W. V., Cincinnati, Dallas

MORE REFRIGERATION TONNAGE AT LESS COST

More than 70 years of engineering and manufacturing experience is incorporated in Vogt refrigerating and ice making equipment. Absorption Systems, Compression Systems, and Tube-Ice Machines in a wide range of capacities serve industrial and processing plants, and institutions, here and abroad.

Industrial Refrigeration Buyers Guide

Product Classification

REFER TO PAGE 49 FOR COMPLETE ADDRESSES
REFER TO PAGE 54 FOR TRADE NAMES

ABSORBERS, VIBRATION

Barry Controls, Inc., Watertown, Mass.
Flon Products Co., Berwyn, Ill.
Flexonics Corp., Maywood, Ill.
Johns-Manville Corp., New York, N. Y.
Korfund Co. Inc., Long Island City, N. Y.
Mundet Cork Corp., North Bergen, N. J.
National Cork Co., Englewood, N. J.
Technifex Corp., Port Jervis, N. Y.
Ten-Tex Corp., Grand Rapids, Mich.
Vibration Mountings, Corona, N. Y.

ABSORPTION SYSTEMS

Consolidated Services Inc., Seattle, Wash.
Worthington Corp., Harrison, N. J.

ACCUMULATORS (See Pressure Vessels)

ACCUMULATORS, ICE STORAGE TYPE (See Tanks, Latent Heat)

ADHESIVES, CEMENTS, COMPOUNDS, COATING (See also Coatings and Compounds)

Aluminal Corp., New York, N. Y.
American Bitumuls & Asphalt Co., San Francisco, Calif.
Armstrong Cork Co., Lancaster, Pa.
Baldwin-Hill Co., Trenton, N. J.
Camp Co. Inc., Chicago, Ill.
Philip Carey Mfg. Co., Cincinnati, Ohio.
Coastal Laboratories, New York, N. Y.
Alfred Hague & Co. Inc., Brooklyn, N. Y.
Jarvis Products, Inc., Chicago, Ill.
Johns-Manville Corp., New York, N. Y.
Miracle Adhesives Corp., New York, N. Y.
MMM, Inc., Houston, Texas.
Godfrey E. Moore, Inc., Danville, Ill.
J. W. Mortell Co., Kankakee, Ill.
Mundet Cork Corp., North Bergen, N. J.
Myatt Adhesive Products, Chicago, Ill.
National Cork Co., Englewood, N. J.
North American Mineral Products Co., Cleveland, Ohio.
E. H. O'Neill Fiscal Co., Cicero, Ill.
Permatite Engineering Co., St. Louis, Mo.
Quigley Co. Inc., New York, N. Y.
Tidewater Co. Inc., Des Moines, Iowa.
Tile, Kilp Mfg. Co. Cambridge, Mass.
United Cork Companies, Kearny, N. J.
Zonolite Co., Chicago, Ill.

ADSORBENTS (See Dehydrants)

AGITATORS, BRINE, ETC.

Ball & Gossett Co., Morton Grove, Ill.
Bell Machine Shop, New Smyrna Beach, Fla.
Home Ice Machine Co., Chicago, Ill.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Kalkhoven Engineering Co., Fullerton, Calif.
Kelvin Machinery Co., Cincinnati, Ohio.
Vilter Mfg. Co., Milwaukee, Wis.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

AIR AGITATING SYSTEMS AND FITTINGS

American Ice Machinery & Equipment Co., Philadelphia, Pa.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
York Corp., York, Pa.

AIR COMPRESSORS (See Compressors, Air, Gas, etc.)

AIR CONDITIONING COILS (See Coils by Types)

AIR FILTERS (See Filters)

AIR PURIFICATION EQUIPMENT

Barnaby-Cheney Co., Columbus, Ohio.
Connor Engineering Corp., Danbury, Conn.
General Ozone Corp., Chicago, Ill.
Trane Co., LaCrosse, Wis.
York Corp., York, Pa.

AIR PURIFICATION MATERIALS (See Also Filters)

Barnaby-Cheney Co., Columbus, Ohio.
Linde Air Products Co., New York, N. Y.
York Corp., York, Pa.

AIR WASHERS (See also Spray Systems)

Air-Purna-Aire Mfg. Co., Paterson, N. J.
Bahnson Co., Winston-Salem, N. C.
Carrier Corp., Syracuse, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Parks Cramer Co., Fitchburg, Mass.
Water Treatment Engineers, Cleveland, Ohio.
York Corp., York, Pa.

ALARMS (See Protective Devices)

AMMONIA

Armour & Co., Chicago, Ill.
Ballard Sales Co., Fort Worth, Texas.
Barada & Page, Inc., Kansas City, Mo.
Henry Bower Chemical Mfg. Co., Philadelphia, Pa.
Dow Chemical Co., Midland, Mich.
Nitrogen Division, Allied Chemical & Dye Corp., New York, N. Y.
Pennsylvania Salt Mfg. Co., Philadelphia, Pa.
Spencer Chemical Co., Kansas City, Mo.

AMMONIA ABSORBERS (See Absorption Systems)

AMMONIA COMPRESSORS (See Compressors)

AMMONIA CONDENSERS (See Condensers)

AMMONIA FITTINGS AND VALVES (See Fittings, Ammonia)

AMMONIA FLOAT VALVES (See Controls)

AMMONIA MASKS (See Safety Appliances)

AMMONIA PACKINGS (See Packings, Mechanical and Metallic)

AMMONIA PUMPS (See Pumps, Ammonia)

AMMONIA RECEIVERS (See Pressure Vessels)

AMMONIA SEPARATORS, TRAPS, INTERCOOLERS, FLASH TANKS, Etc. (See Pressure Vessels)

ARCHITECTS (Specializing in Refrigeration Construction) (See Consulting Engineers and Architects)

ASPHALT AND ASPHALT COMPOUNDS (See Coatings, Cements and Compounds)

ATOMIZERS (See Spray Systems and Accessories)

AUTOMATIC CONTROL DEVICES (See Controls by Type)

BAGS, ICE

Ballard Sales Co., Fort Worth, Texas.
Canvas Fabricators, Chicago, Ill.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
John H. Marcott, Inc., St. Albans, N. Y.
Union Canvas Goods Co., Philadelphia, Pa.

BATTERIES, STORAGE

Exide Industrial Division, Electric Storage Battery Co., Philadelphia, Pa.
Lewis-Shepard Products, Inc., Watertown, Mass.

BEARINGS, BALL AND ROLLER

Link-Belt Co., Chicago, Ill.

BEARINGS, SLEEVE

Link-Belt Co., Chicago, Ill.

BELTS AND BELTING

Flatico Corp., Brooklyn, N.Y.
E. F. Houghton & Co., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.
Mavrey Mfg. Corp., Chicago, Ill.
Ten-Tex Corp., Grand Rapids, Mich.

BLAST FREEZERS (See Freezing Systems)

BLOWERS AND FANS (See Fans)

BRAZING (See Welding Equipment)

BRINE CIRCULATORS (See Agitators)

BRINE COOLERS AND CHILLERS

Acme Industries, Inc., Jackson, Mich.
Aircraft Production Engineers, Chicago, Ill.
Richard M. Armstrong Co., West Chester, Pa.
Ball & Gossett Co., Morton Grove, Ill.
Bass Products, Inc., Brooklyn, N. Y.
Bayle & Bath Mfg. Co. Inc., Brooklyn, N. Y.
Filtrine Mfg. Co., Brooklyn, N. Y.
Frick Co., Waynesboro, Pa.
Heat-X Inc., Brewster, N. Y.
Home Ice Machine Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kalkhoven Engineering Co., Fullerton, Calif.
Kiefer Coil Co., St. Louis, Mo.
Milgram Blower Co., New York, N. Y.
Patterson-Kelley Co. Inc., East Stroudsburg, Pa.
Rotary Products Co., Canton, Ohio.
Vilter Mfg. Co. Milwaukee, Wis.
Wayne Vent Machine Co., Louisville, Ky.
J. F. Wolfkiel Co., Maywood, Ill.
Wolf Machine Works, Brooklyn, N. Y.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

BRINE PUMPS (See Pumps by Types)

BRINE SPRAYING SYSTEMS

Binks Manufacturing Co., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
York Corp., York, Pa.

BRINE TANKS

Aircraft Production Engineers, Chicago, Ill.
Alpha Electric Refrigeration Co., Detroit, Mich.
Bell & Gossett Co., Morton Grove, Ill.
Dole Refrigerating Co., Chicago, Ill.
Frick Co., Waynesboro, Pa.
General Controls Co., Glendale, Calif.
Kohlenberger Engineering Co., Fullerton, Calif.
Vilter Mfg. Co., Milwaukee, Wis.
Whitlock Mfg. Co., West Hartford, Conn.
York Corp., York, Pa.

BRINE TREATMENT (See Water and Brine Treatment)

CALCIUM CHLORIDE

Barada & Page, Inc., Kansas City, Mo.
Columbia Southern Chemical Corp., Pittsburgh, Pa.
Dow Chemical Co., Midland, Mich.
Solvay Process Division, Allied Chemical & Dye Corp., New York, N. Y.
Tufcrete Co. Inc., Des Moines, Iowa.
Wyandotte Chemicals Corp., Wyandotte, Mich.
York Corp., York, Pa.

CAPACITORS (See Electrical Line Equipment)

CARBON DIOXIDE REFRIGERATING SYSTEMS AND COLLECTORS

Clark Bros. Co., Olean, N. Y.
Frick Co., Waynesboro, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
Worthington Corp., Harrison, N. J.

CARBON DIOXIDE, SOLID CARBONIC ACID REFRIGERATING SYSTEMS

Frick Co., Waynesboro, Pa.
Franklin P. Miller & Sons Inc., East Orange, N. J.

CHARGING LINES

Dole Refrigerator Co., Chicago, Ill.
Flow Products Co., Berwyn, Ill.
Flexonics Corp., Maywood, Ill.
Frick Co., Waynesboro, Pa.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Jarvis Products Inc., Chicago, Ill.
Vibration Mountings, Corona, N. Y.
York Corp., York, Pa.

CHILLERS AND COOLERS

Acme Industries, Inc., Jackson, Mich.
Aircraft Production Engineers, Chicago, Ill.
Airtemp Division, Chrysler Corp., Dayton, Ohio.
Alpha Electric Refrigeration Co., Detroit, Mich.
American Coils Co., Newark, N. J.
Richard M. Armstrong Co., West Chester, Pa.
Carrier Corp., Syracuse, N. Y.
Creamery Package Mfg. Co., Chicago, Ill.
Dean Products, Inc., Brooklyn, N. Y.
Doyle & Roth Mfg. Co. Inc., Brooklyn, N. Y.
Drayer-Hanson, Inc., Los Angeles, Calif.
Filtrine Mfg. Co., Brooklyn, N. Y.
Gay Engineering Corp., Los Angeles, Calif.
Heatron, Inc., York, Pa.
Heat-X Inc., Brewster, N. Y.
Howe Ice Machine Co., Chicago, Ill.
Kennard Corp., St. Louis, Mo.
Kohlenberger Engineering Co., Fullerton, Calif.
LaCrosse Cooler Co., LaCrosse, Wis.
McQuay, Inc., Minneapolis, Minn.
Mojonnier Bros., Chicago, Ill.
Nor-Lake Inc., Hudson, Wis.
Patterson-Kelley Co. Inc., East Stroudsburg, Pa.
Recoy Products Co., Canton, Ohio.
Schnacke, Inc., Evansville, Ind.
Temprite Products Corp., Birmingham, Mich.
Trenter Mfg. Inc., Lansing, Mich.
Vilter Mfg. Co., Milwaukee, Wis.
Henry Vogt Machine Co., Louisville, Ky.
J. E. Watkins Co., Maywood, Ill.
Whitlock Mfg. Co., West Hartford, Conn.
Wolf Condenser Work, Brooklyn, N. Y.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

COATINGS, CEMENTS AND COMPOUNDS

Armite Laboratories, Los Angeles, Calif.
American Bitumuls & Asphalt Co., San Francisco, Calif.
Anderson Chemical Co. Inc., Macon, Ga.
Armstrong Cork Co., Lancaster, Pa.
Baldwin-Hill Co., Trenton, N. J.
Camp Co. Inc., Chicago, Ill.
Carbollasum Wood Preserving Co., Milwaukee, Wis.
Philip Carey Mfg. Co., Cincinnati, Ohio.
Chemical Div., Galvicon Corp., New York, N. Y.
Chemical Engineering Co. Inc., Dallas, Texas.
Chemical Solvent Co., Birmingham, Ala.
Chemsol, Inc., Elizabeth, N. J.
Coating Laboratories, Inc., Tulsa, Okla.
Constad Laboratories, New York, N. Y.
Alfred Hague & Co. Inc., Brooklyn, N. Y.
AC Horn Division, Sun Chemical Corp., Long Island, N. Y.
Johns-Manville Corp., New York, N. Y.
Miracle Adhesives Corp., New York, N. Y.
MMM, Inc., Houston, Texas.
J. W. Mortell Co., Kankakee, Ill.
Mystik Adhesive Products, Chicago, Ill.
National Cork Co., Englewood, N. J.
North American Mogul Products Co., Cleveland, Ohio.
Oakite Products, Inc., New York, N. Y.
E. H. O'Neill Floors Co., Cicero, Ill.
Patterson-Kelley Co. Inc., East Stroudsburg, Pa.
Pennsylvania Salt Mfg. Co., Philadelphia, Pa.
Presstite Engineering Co., St. Louis, Mo.
Quigley Co., Inc., New York, N. Y.
Tropical Paint Co., Cleveland, Ohio.
Tufcrete Co. Inc., Des Moines, Iowa.
Water Treatment Engineers, Cleveland, Ohio.
Wilbur & Williams Co., Brighton, Boston, Mass.
Wyandotte Chemicals Corp., Wyandotte, Mich.
United Cork Companies, Kearny, N. J.

COILS, BENDS AND BAFFLE ASSEMBLIES

Aircraft Production Engineers, Chicago, Ill.
Carrier Corp., Syracuse, N. Y.
Chicago Nipple Mfg. Co., Chicago, Ill.
Dean Products, Inc., Brooklyn, N. Y.
Dunham-Bush, Inc., West Hartford, Conn.
Frick Co., Waynesboro, Pa.
Howe Ice Machine Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kohlenberger Engineering Co., Fullerton, Calif.
National Pipe Bending Co., New Haven, Conn.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Engineering Inc., Los Angeles, Calif.
Reliance Electric Machine Co., Cleveland, Ohio.
Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Tenney Engineering Inc., Union, N. J.
Trenter Mfg. Inc., Lansing, Mich.
Vilter Mfg. Co., Milwaukee, Wis.
Henry Vogt Machine Co., Louisville, Ky.
Whitlock Mfg. Co., West Hartford, Conn.
York Corp., York, Pa.

COILS, BLOWER UNITS

Advanced Engineering Corp., Milwaukee, Wis.
Aircraft Production Engineers, Chicago, Ill.
Airtemp Division, Chrysler Corp., Dayton, Ohio.
American Air Filter Co., Louisville, Ky.
American Coils Co., Newark, N. J.
American Ice Machinery & Equipment Co., Philadelphia, Pa.
Baltimore Aircoil Inc., Baltimore, Md.
Carrier Corp., Syracuse, N. Y.
Dean Products, Inc., Brooklyn, N. Y.
Drayer-Hanson, Inc., Los Angeles, Calif.
Dunham-Bush, Inc., West Hartford, Conn.
Filtrine Mfg. Co., Brooklyn, N. Y.
Howe Ice Machine Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kennard Corp., St. Louis, Mo.
Kohlenberger Engineering Co., Fullerton, Calif.
Kramer Trenton Co., Trenton, N. J.
McQuay, Inc., Minneapolis, Minn.
Nor-Lake Inc., Hudson, Wis.
Recoy Products Co., Canton, Ohio.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Engineering, Inc., Los Angeles, Calif.
Rempe Co., Chicago, Ill.
Slant-Fin Radiator Corp., Richmond Hill, N. Y.
Tenney Engineering Inc., Union, N. J.
Trane Co., LaCrosse, Wis.
U.S. Air Conditioning Corp., Philadelphia, Pa.
U.S. Thermo Controls Co., Minneapolis, Minn.
Vilter Mfg. Co., Milwaukee, Wis.
J. E. Watkins Co., Maywood, Ill.
A. H. Witt Co., Los Angeles, Calif.
York Corp., York, Pa.
Young Radiator Co., Racine, Wis.

COILS, FIN

Advanced Engineering Corp., Milwaukee, Wis.
Aircraft Production Engineers, Chicago, Ill.
Airtemp Division, Chrysler Corp., Dayton, Ohio.
American Air Filter Co., Louisville, Ky.
Carrier Corp., Syracuse, N. Y.
Dean Products, Inc., Brooklyn, N. Y.
Detroit Ice Machine Co., Detroit, Mich.
Dole Refrigerating Co., Chicago, Ill.
Drayer-Hanson, Inc., Los Angeles, Calif.
Dunham-Bush, Inc., West Hartford, Conn.
Frick Co., Waynesboro, Pa.
Halstead & Mitchell, Pittsburgh, Pa.
Heatron, Inc., York, Pa.
Howe Ice Machine Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kohlenberger Engineering Co., Fullerton, Calif.
Kramer Trenton Co., Trenton, N. J.
McQuay, Inc., Minneapolis, Minn.
Mario Coil Co., St. Louis, Mo.
Recoy Products Co., Canton, Ohio.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Engineering, Inc., Los Angeles, Calif.
Schutte & Koerting Co., Cornwells Heights, Pa.
Tenney Engineering Inc., Union, N. J.
Trane Co., LaCrosse, Wis.
Typhoon Air Conditioning Co., Brooklyn, N. Y.
Vilter Mfg. Co., Milwaukee, Wis.
J. E. Watkins Co., Maywood, Ill.
A. H. Witt Co., Los Angeles, Calif.
York Corp., York, Pa.

COILS, PLATE

Advanced Engineering Corp., Milwaukee, Wis.
Dunham-Bush, Inc., West Hartford, Conn.
Dole Refrigerating Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kennard Corp., St. Louis, Mo.
Kohlenberger Engineering Co., Fullerton, Calif.
Rempe Co., Chicago, Ill.
Trenter Mfg. Inc., Lansing, Mich.
Young Radiator Co., Racine, Wis.

COIN DEVICES

Bullard Sales Co., Fort Worth, Texas.

COLD STORAGE DOORS (See Doors, Cold Storage)

COLD STORAGE INSULATION See Insulation)

COMPOUNDS, CORROSION INHIBITING (See Water Treating Materials)

COMPRESSOR PARTS AND ACCESSORIES

Brunner Mfg. Co., Utica, N. Y.
Clark Bros. Co., Olean, N. Y.
Frick Co., Waynesboro, Pa.
Hubbell Corp., Mendelein, Ill.
Kohlenberger Engineering Co., Fullerton, Calif.
Reliance Electric Machine Co., Cleveland, Ohio.
Schnacke, Inc., Evansville, Ind.
Trane Co., LaCrosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
J. H. H. Voss Co. Inc., New York, N. Y.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

COMPRESSORS, AIR, GAS, Etc.

Bell & Gossett Co., Morton Grove, Ill.
Binks Manufacturing Co., Chicago, Ill.
Brunner Mfg. Co., Utica, N. Y.
Carrier Corp., Syracuse, N. Y.
Clark Bros. Co., Olean, N. Y.
Johnson Service Co., Milwaukee, Wis.
Nash Engineering Co., South Norwalk, Conn.
Roots Connersville Blower Div., Dresser Industries, Inc., Connersville, Ind.
Vilter Mfg. Co., Milwaukee, Wis.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

COMPRESSORS, AIR FOR ICE MAKING

Clark Bros. Co., Olean, N. Y.
Roots Connersville Blower Div., Dresser Industries, Inc., Connersville, Ind.
York Corp., York, Pa.

COMPRESSORS, BOOSTER (Also Refer to Compressor Types Below)

Clark Bros. Co., Olean, N. Y.
Creamery Package Mfg. Co., Chicago, Ill.
Freezing Equipment Sales, Inc., York, Pa.
Howe Ice Machine Co., Chicago, Ill.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

COMPRESSORS, REFRIGERATING, CARBON DIOXIDE (See Carbon Dioxide Systems)

COMPRESSORS, REFRIGERATING CENTRIFUGAL

Carrier Corp., Syracuse, N. Y.
Clark Bros. Co., Olean, N. Y.
Creamery Package Mfg. Co., Chicago, Ill.
Trane Co., LaCrosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric Corp., Pittsburgh, Pa.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

COMPRESSORS, REFRIGERATING, RECIPROCATING

Aircraft Production Engineers, Chicago, Ill.
Airtemp Div., Chrysler Corp., Dayton, Ohio.
Brunner Mfg. Co., Utica, N. Y.
Carrier Corp., Syracuse, N. Y.
Clark Bros. Co., Olean, N. Y.
Dorsch, Gosnell & Nesbit, Inc., Chicago, Ill.
Frick Co., Waynesboro, Pa.
Howe Ice Machine Co., Chicago, Ill.
Kohlenberger Engineering Co., Fullerton, Calif.
Reliance Electric Machine Co., Cleveland, Ohio.
Reynolds Mfg. Co., Springfield, Mo.
Schnacke, Inc., Evansville, Ind.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

COMPRESSORS, REFRIGERATING, ROTARY

Freezing Equipment Sales, Inc., York, Pa.
Howe Ice Machine Co., Chicago, Ill.
Roots Connersville Blower Div., Dresser Industries, Inc., Connersville, Ind.

Vilter Mfg. Co., Milwaukee, Wis.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

CONDENSER PARTS AND ACCESSORIES

Frick Co., Waynesboro, Pa.
Hubbell Corp., Mendota, Ill.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Kuhlenberger Engineering Co., Fullerton, Calif.
Refiance Electric Machine Co., Cleveland, Ohio.
Trane Co., LaCrosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
J. E. Watkins Co., Maywood, Ill.
Wolf Condenser Works, Brooklyn, N. Y.
York Corp., York, Pa.

CONDENSERS, AIR COOLED

Aircraft Production Engineers, Chicago, Ill.
Airtemp Div., Chrysler Corp., Dayton, Ohio.
American Coils Co., Newark, N. J.
Carrier Corp., Syracuse, N. Y.
Dean Products Inc., Brooklyn, N. Y.
Draper-Hansen, Inc., Los Angeles, Calif.
Dunham-Bush, Inc., West Hartford, Conn.
Filtrine Mfg. Co., Brooklyn, N. Y.
Frick Co., Waynesboro, Pa.
Halstead & Mitchell, Pittsburgh, Pa.
Home Ice Machine Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kuhlenberger Engineering Co., Fullerton, Calif.
Kramer Trenton Co., Trenton, N. J.
McQuay, Inc., Minneapolis, Minn.
Marlo Coil Co., St. Louis, Mo.
Refrigeration Appliances Inc., Chicago, Ill.
Remco Co., Chicago, Ill.
Tuttle Engineering Inc., Union, N. J.
Trane Co., LaCrosse, Wis.
U.S. Air Conditioning Corp., Philadelphia, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
A. H. Wirz Co., Los Angeles, Calif.
Wolf Condenser Works, Brooklyn, N. Y.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

CONDENSERS, ATMOSPHERIC

Aircraft Production Engineers, Chicago, Ill.
Home Ice Machine Co., Chicago, Ill.
Kuhlenberger Engineering Co., Fullerton, Calif.
Trane Co., LaCrosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
J. E. Watkins Co., Maywood, Ill.
Wolf Condenser Works, Brooklyn, N. Y.
York Corp., York, Pa.

CONDENSERS, CARBON DIOXIDE (See Also Carbon Dioxide Carbonic Acid Refrigerating Systems)

Sipix & Reich Mfg. Co., Brooklyn, N. Y.
Vilter Mfg. Co., Milwaukee, Wis.
Wolf Condenser Works, Brooklyn, N. Y.

CONDENSERS, COMBINATION AIR AND WATER COOLED

Draper-Hansen, Inc., Los Angeles, Calif.
Halstead & Mitchell, Pittsburgh, Pa.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Marlo Coil Co., St. Louis, Mo.
Schutte & Koerting Co., Cornwell Heights, Pa.
Standard Refrigeration Co., Chicago, Ill.
Trane Co., LaCrosse, Wis.
U.S. Air Conditioning Corp., Philadelphia, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
Henry Vogt Machine Co., Louisville, Ky.
J. E. Watkins Co., Maywood, Ill.
Wolf Condenser Works, Brooklyn, N. Y.
York Corp., York, Pa.

CONDENSERS, EVAPORATIVE

Acme Industries, Inc., Jackson, Mich.
Aircraft Production Engineers, Chicago, Ill.
Baltimore Aircoil Co. Inc., Baltimore, Md.
Bell & Gossett Co., Morton Grove, Ill.
Carrier Corp., Syracuse, N. Y.
Dean Products, Inc., Brooklyn, N. Y.
Draper-Hansen, Inc., Los Angeles, Calif.
Dunham-Bush, Inc., West Hartford, Conn.
Frick Co., Waynesboro, Pa.
Home Ice Machine Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kennard Corp., St. Louis, Mo.
Kuhlenberger Engineering Co., Fullerton, Calif.
McQuay, Inc., Minneapolis, Minn.
Marlo Coil Co., St. Louis, Mo.
Niagara Blower Co., New York, N. Y.
Remco Co., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Engineering, Inc., Los Angeles, Calif.
Schutte & Koerting Co., Cornwell Heights, Pa.
Tuco Heaters Inc., Providence, R. I.
Tuttle Engineering, Inc., Union, N. J.
Trane Co., LaCrosse, Wis.
U.S. Air Conditioning Corp., Philadelphia, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
J. E. Watkins Co., Maywood, Ill.
Wolf Condenser Works, Brooklyn, N. Y.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.
Young Radiator Co., Racine, Wis.

CONDENSERS, SHELL AND COIL, SHELL AND TUBE, AND SPECIAL

Acme Industries, Inc., Jackson, Mich.
Aircraft Production Engineers, Chicago, Ill.
Airtemp Div., Chrysler Corp., Dayton, Ohio.
Richard M. Armstrong Co., West Chester, Pa.
Bell & Gossett Co., Morton Grove, Ill.
Bundy Mfg. Co., Detroit, Mich.
Carrier Corp., Syracuse, N. Y.
Dench, Gammeter & Mowry, Inc., Chicago, Ill.
Doyle & Roth Mfg. Co. Inc., Brooklyn, N. Y.
Elliott Co., Jeannette, Pa.
Filtrine Mfg. Co., Brooklyn, N. Y.
Frick Co., Waynesboro, Pa.
Halstead & Mitchell, Pittsburgh, Pa.
Heatron, Inc., York, Pa.
Hoat-X Inc., Brewster, N. Y.
Home Ice Machine Co., Chicago, Ill.
Kuhlenberger Engineering Co., Fullerton, Calif.
Patterson-Kelley Co. Inc., East Stroudsburg, Pa.
Refiance Electric Machine Co. Cleveland, Ohio.
Remco Co., Chicago, Ill.
Schutte & Koerting Co., Cornwells Heights, Pa.
Standard Refrigeration Co., Chicago, Ill.
Trane Co., LaCrosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
Henry Vogt Machine Co., Louisville, Ky.
Whitlock Mfg. Co., West Hartford, Conn.
Wolf Condenser Works, Brooklyn, N.Y.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.
Young Radiator Co., Racine, Wis.

CONDENSERS, WATER REGULATING VALVE

Bailey Meter Co., Cleveland, Ohio.
Halstead & Mitchell, Pittsburgh, Pa.
Hubbell Corp., Mendota, Ill.
Refrigerating Specialties Co., Chicago, Ill.
York Corp., York, Pa.

CONSULTING ENGINEERS AND ARCHITECTS

C. Burton Albright, C. E., New York, N. Y.
Anemone, Davis & Stout, Inc., Indianapolis, Ind.
C. Thomas Baker, Atlanta, Ga.
C. E. Baskerville & Son, Richmond, Va.
Stephen J. Bass, C. E., Philadelphia, Pa.
H. E. Bauser & Associates, Inc., Detroit, Mich.
Dozier Bledsoe, Orlando, Fla.
Brice & Bird Associates, Minneapolis, Minn.
George B. Bright Co., Detroit, Mich.
Robert T. Brinsmade, New York, N. Y.
S. W. Brown, New York, N. Y.
Collins Engineering Co., Seattle, Wash.
Conrad Johnston & Wright, Richmond, Va.
Corry & Miller, Cleveland, Ohio.
Burke E. Crane, C. E., Rochester, N. Y.
Phillip E. Dawson, C. E., Philadelphia, Pa.
Jay R. Downer, Norfolk, Conn.
M. L. Diver, C. E., San Antonio, Texas.
Engineering Associates, San Francisco, Calif.
A. Epstein & Sons, Inc., Chicago, Ill.
Ferris & Hooks, C. E's, St. Louis, Mo.
Sheridan E. Fiss Associates, Chicago, Ill.
Max J. Fluegen Co., Los Angeles, Calif.
Forster & Hilling, Cincinnati, Ohio.
Thayer Francis, Boston, Mass.
Cary B. Gamble & Associates, New Orleans, La.
John Gaynor, San Francisco, Calif.
Francis T. Green, C. E., Irvington, N. J.
Van R. H. Green, New York, N. Y.
Lyman C. Gross, Minneapolis, Minn.
Hansell & Hoyer, Memphis, Tenn.
Robert E. Hattis, Chicago, Ill.
Charles D. Hoak, Toledo, Ohio.
Hoffman Brunk & Gramm, Chicago, Ill.
Howard A. Holmes, Plainfield, N. J.
E. F. Hoff Co., Brentwood, N. J.
Thomas C. Kimball, Yuca, Calif.
Carl J. Kiefer Associates Inc., Cincinnati, Ohio.
A. M. Kinney Inc., Cincinnati, Ohio.
Wm. F. Kiolis Sons Inc., Philadelphia, Pa.
Jens Kjaergaard, Chicago, Ill.
C. S. Lapsley, Philadelphia, Pa.
Samuel Leslie, New York, N. Y.
Samuel R. Lewis, Chicago, Ill.
Arthur D. Little Co., Cambridge, Mass.
Allen P. Liver, New York, N. Y.
Edwin J. Lockwood, Pittsford, N.Y.
Lockwood, Greene & Engineers, Chicago, Ill.
Miles O. Lohr, Birmingham, Ala.
Alex H. Loudon, Sr., Minneapolis, Wis.
Madsen Engineering Corp., New York, N.Y.
Mahoney-Ross Mach. Co. Inc., Buffalo, N.Y.
J. W. Mantor, Jr., Glen Ridge, N.J.
Fred Oplatz, New York, N.Y.
Morse H. Patrick, Bernardsville, N.J.
W. C. Patterson & Associates, York, Pa.
Patterson & Davis, Philadelphia, Pa.
Howard N. Peterson, Yakima, Wash.
James Posey, Baltimore, Md.
Louis P. Price, Dallas, Texas.
Rust Engineering Co., Birmingham, Ala.
Alfred H. Schaer, New Orleans, La.
Schmidt, Garden & Erikson, Chicago, Ill.
Sanks Engineering Co., Philadelphia, Pa.
Edward Stevens, San Francisco, Calif.
James M. Smith, San Francisco, Calif.
Stanley Engineering & Sons, Chicago, Ill.
Stanley D. Smith Inc., New York, N.Y.
W. A. Stokes, Burbank, Calif.
J. W. Stockham, Washington, D.C.
William E. Stone, Seattle, Wash.
Leslie S. Tarleton, C. E., Philadelphia, Pa.
Parke M. Thompson, Richmond, Va.
James M. Todd, New Orleans, La.
J. Gordon Turnbull, Inc., Cleveland, Ohio.
Herman Vetter, Los Angeles, Calif.
J. H. Wickersham, Lancaster, Pa.
S. E. Weiland, Seattle, Wash.
E. T. Williams, C. E., New York, N.Y.
James K. Wetherd, Baltimore, Md.
D. H. Wyatt, Columbus, Ohio.

CONTINUOUS FREEZERS (See Freezing Systems)

CONTROL LIQUID LEVEL (See Also Liquid Return Systems)

Alco Valve Co., St. Louis, Mo.
Atlas Valve Co., Newark, N.J.
Automatic Temperature Control Co., Philadelphia, Pa.
Bailey Meter Co., Cleveland, Ohio.
Bristol Co., Waterbury, Conn.
Fielden Instrument Div., Robertshaw-Fulton Controls Co., Philadelphia, Pa.
Fisher Governor Co., Marshalltown, Iowa
Fusiere Co., Foxboro, Mass.
Freezing Equipment Sales, Inc., York, Pa.
Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Knoxville, Tenn.
Hubbell Corp., Mendota, Ill.
Leeds and Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Norwood, Mass.
Mercoid Corp., Chicago 41, Ill.
Meterstat Prod. Co., Chicago, Ill.
H. A. Phillips & Co., Chicago, Ill.
Ruppler-Klapman Mfg. Co., Salem, Mass.
Sporlan Valve Co., St. Louis, Mo.
Vilter Mfg. Co., Milwaukee, Wis.
Henry Vogt Machine Co., Louisville, Ky.
J. E. Watkins Co., Maywood, Ill.
York Corp., York, Pa.

CONTROLS, FLOAT SWITCHES

Alco Valve Co., St. Louis, Mo.
Bristol Co., Waterbury, Conn.
General Electric Co., Schenectady, N.Y.
Hubbell Corp., Mendota, Ill.
Mercoid Corp., Chicago, Ill.
Meterstat Prod. Co., Chicago, Ill.
H. A. Phillips & Co., Chicago, Ill.

CONTROLS, FLOAT VALVES

Alco Valve Co., St. Louis, Mo.
Allen-Bradley Co., Milwaukee, Wis.
Armstrong Machine Works, Three Rivers, Mich.
Atlas Valve Co., Newark, N.J.
Bristol Co., Waterbury, Conn.
Fisher Governor Co., Marshalltown, Iowa.
Frick Co., Waynesboro, Pa.
Fulton Sylphon Div., Robertshaw-Fulton Controls, Knoxville, Tenn.
Hubbell Corp., Mendota, Ill.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Leeds & Northrup, Philadelphia, Pa.
Mid-O-Mist Inc., Chicago, Ill.
James P. Marsh Corp., Skokie, Ill.
Mason-Neilan Regulator Co., Norwood, Mass.
Trane Co., LaCrosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

CONTROLS, HUMIDITY (See Humidifying and Dehumidifying Systems)

CONTROLS, MOTOR (See Motor Controls and Starters)

CONTROLS, PRESSURE ACTUATED

Alco Valve Co., St. Louis, Mo.
Allen-Bradley Co., Milwaukee, Wis.
A. P. Controls Corp., Milwaukee, Wis.
Atlas Valve Co., Newark, N.J.
Automatic Temperature Control Co., Philadelphia, Pa.
Bailey Meter Co., Cleveland, Ohio.
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
A. W. Cash Valve Mfg. Corp., Decatur, Ill.
Dench, Gammeter & Mowry, Inc., Chicago, Ill.
Detroit Controls Corp., Detroit, Mich.
Fisher Governor Co., Marshalltown, Iowa.
Fusiere Co. Foxboro, Mass.
Fulton Sylphon Div., Robertshaw-Fulton Controls, Knoxville, Tenn.
General Controls Co., Glendale, Calif.
General Electric Co., Schenectady, N.Y.
Hubbell Corp., Mendota, Ill.
Mason-Neilan Regulator Co., Norwood, Mass.
Mercoid Corp., Chicago, Ill.
Powers Regulator Co., Skokie, Ill.

CONTROLS, SUCTION PRESSURE ACTUATED

Alco Valve Co., St. Louis, Mo.
Allen-Bradley Co., Milwaukee, Wis.
A. P. Controls Corp., Milwaukee, Wis.
Bailey Meter Co., Cleveland, Ohio.
Bristol Company, Waterbury, Conn.
A. W. Cash Valve Mfg. Corp., Decatur, Ill.
Dench, Gammeter & Mowry, Inc., Chicago, Ill.
Detroit Controls Corp., Detroit, Mich.

Fisher Governor Co., Marshalltown, Iowa.
Hubbell Corp., Mandeleln, Ill.
Mason-Neilan Regulator Co., Norwood, Mass.
Mercoid Corp., Chicago, Ill.
Refrigerating Specialties Co., Chicago, Ill.
U. S. Thermo Controls Co., Minneapolis, Minn.
York Corp., York, Pa.

CONTROLS, TEMPERATURE ACTUATED (See Expansion Valves)

CONVEYORS AND COMPONENTS

Ballard Sales Co., Fort Worth, Texas
K. G. Brown Mfg. Co., Inc., Mattituck, N.Y.
Browning Mfg. Co., Maysville, Ky.
Creamery Package Mfg. Co., Chicago, Ill.
Gifford-Wood Co., Hudson, N.Y.
Hall Machine Shop, New Smyrna Beach, Fla.
Lilly Co., Memphis, Tenn.
Link-Belt Co., Chicago, Ill.
Refrigeration Engineering Co., Minneapolis, Minn.
S & S Vending Machine Co., San Jose, Calif.
Ten-Tex Corp., Grand Rapids, Mich.
United States Hoffman Corp., New York, N.Y.

COOLERS, BRINE (See Brine Coolers and Chillers)

COOLING TOWERS

Acme Industries Inc., Jackson, Mich.
American Coils Co., Newark, N.J.
Baltimore Aircoil Co., Baltimore, Md.
Binks Manufacturing Co., Chicago, Ill.
Carrier Corp., Syracuse, N.Y.
Dover Manufacturing Co., Independence, Mo.
Drayer-Hanson, Inc., Los Angeles, Calif.
Dunham-Bush, Inc., West Hartford, Conn.
E. D. Goodfellow Co. Inc., Memphis, Tenn.
Halstead & Mitchell, Pittsburgh, Pa.
Havens Structural Steel Co., Kansas City, Mo.
Kennard Corp., St. Louis, Mo.
Kohlenberger Engineering Co., Fullerton, Calif.
Kramer Trenton Co., Trenton, N.J.
Lillie-Hoffmann Cooling Towers, Inc., St. Louis, Mo.
McQuay, Inc., Minneapolis, Minn.
Marley Co., Kansas City, Mo.
Marlo Coil Co., St. Louis, Mo.
J. F. Pritchard & Co. of California, Kansas City, Mo.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Engineering, Inc., Los Angeles, Calif.
Schnacke Inc., Evansville, Ind.
Schutte & Koerting, Cornwells Heights, Pa.
Tenney Engineering Inc., Union, N.J.
Thermal Agency, Houston, Texas.
TOT Towers Inc., Houston, Texas.
Water Cooling Corp., New York, N.Y.
Water Cooling Equipment Co. St. Louis, Mo.
A. H. Witt Co., Los Angeles, Calif.
Wolf Condenser Works, Brooklyn, N.Y.
Worthington Corp., Harrison, N.J.
York Corp., York, Pa.

CORK INSULATION PRODUCTS (See Insulation)

CORROSION CONTROL (See Protective Coatings)

COUPLINGS (See Drives)

CRANES AND HOISTS

Ballard Sales Co., Fort Worth, Texas.
K. G. Brown Mfg. Co., Mattituck, N.Y.
Frick Co., Waynesboro, Pa.
Hall Machine Shop, New Smyrna Beach, Fla.
Harnischfeger Corp., Milwaukee, Wis.
Ice Plant Equipment Co., Inc., Philadelphia, Pa.
Lewis-Shepard Products, Inc., Watertown, Mass.
Robbins & Myers, Inc., Springfield, Ohio.
York Corp., York, Pa.

CRANKSHAFTS (See Compressor Parts and Accessories)

CREAMERY AND DAIRY MACHINERY (See Dairy Equipment)

DAIRY EQUIPMENT

Agric Machinery Corp., New York, N.Y.
Creamery Package Mfg. Co., Chicago, Ill.
Mojonnier Bros., Chicago, Ill.

DAMPER MOTORS AND REGULATORS

Bailey Meter Co., Cleveland, Ohio.
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
General Controls Co., Glendale, Calif.
General Electric Co., Schenectady, N.Y.
Johnson Service Co., Milwaukee, Wis.
Powers Regulator Co. Skokie, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Wm. Steinen Mfg. Co., Newark, N.J.
Trane Co., LaCrosse, Wis.
York Corp., York, Pa.

DEAERATING SYSTEMS

Elliott Co., Jeannette, Pa.
Permutit Co., New York, N.Y.
Worthington Corp., Harrison, N.J.
Wright Chemical Corp., Chicago, Ill.

DEEP WELL PUMPS (See Pumps, Deep Well)

DEFROSTING SYSTEMS

Aero Electric Corp., Franklin Park, Ill.
Dunham-Bush, Inc., West Hartford, Conn.
Dole Refrigerating Co., Chicago, Ill.
Dunham-Bush, Inc., West Hartford, Conn.
Hubbell Corp., Mandeleln, Ill.
Kohlenberger Engineering Co., Fullerton, Calif.
Kramer Trenton Co., Trenton, N.J.
McQuay, Inc., Minneapolis, Minn.
Niagara Blower Co., New York, N.Y.
H. A. Phillips & Co., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Engineering, Inc., Los Angeles, Calif.
Tenney Engineering, Inc., Union, N.J.
J. E. Watkins Co., Maywood, Ill.
York Corp., York, Pa.

DEHUMIDIFYING SYSTEMS (See Also Humidifying Systems)

Air-Perma-Ator Mfg. Co., Paterson, N.J.
Columbia Southern Chemical Corp., Pittsburgh, Pa.
Carrier Corp., Syracuse, N.Y.
Desomatic Products, Inc., Falls Church, Va.
Drayer-Hanson, Inc., Los Angeles, Calif.
Dryomatic Corp., Alexandria, Va.
Johnson Service Co., Milwaukee, Wis.
Marlo Coil Co., St. Louis, Mo.
Niagara Blower Co., New York, N.Y.
Parks Cramer Co., Fitchburg, Mass.
Partlow Corp., New Hartford, N.Y.
J. F. Pritchard & Co. of California, Kansas City 12, Mo.
Trane Co., LaCrosse, Wis.
Worthington Corp., Harrison, N.J.

DEHYDRANTS

Allin Manufacturing Co., Chicago, Ill.
Ansul Chemical Co., Marinette, Wis.
A. P. Controls Corp., Milwaukee, Wis.
Barnsdey-Cheney Company, Columbus, Ohio.
Columbia Southern Chemical Corp., Pittsburgh, Pa.
Fine Products Co., Berwyn, Ill.
Henry Valve Co., Melrose Park, Ill.
Johns-Manville Corp., New York, N.Y.
Reliance Electric Machine Co., Cleveland, Ohio.
Spartan Valve Co., St. Louis, Mo.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Trane Co., LaCrosse, Wis.
Zeolite Co., Chicago, Ill.

DEIONIZING EQUIPMENT (See Deaerating Systems)

DESICCANTS (See Dehydrants)

DE-SUPERHEATERS, REFRIGERANTS

Industrial Mfg. & Engineering Co., Chicago, Ill.
Whitlock Mfg. Co., West Hartford, Conn.
Worthington Corp., Harrison, N.J.

DIESEL ENGINES

Allis-Chalmers Buda Div., Harvey, Ill.
Caterpillar Tractor Co., Peoria, Ill.
Clark Bros. Co., Olean, N.Y.
Detroit Diesel Eng. Div. of General Motors Corp., Detroit, Mich.
Harnischfeger Corp., Milwaukee, Wis.
Hercules Motors Corp., Canton, Ohio.
R. H. Sheppard Company, Inc., Hanover, Pa.
Worthington Corp., Harrison, N.J.

DIFFUSERS, AIR (See Grilles)

DISCS, COMPRESSOR VALVES (See Compressor Parts and Accessories)

DISTRIBUTORS, CONDENSER WATER (See Condenser Accessories)

DOOR ACCESSORIES AND HARDWARE, COLD STORAGE

Butcher Boy Refrigerator Door Co., Chicago, Ill.
Chase Cold Storage Door Co., Reading, Ohio.
Chase Industrial Refrigeration Equipment Co., Reading, Ohio
Chemsol, Inc., Elizabeth, N.J.
Ice Plant Equipment Co., Inc., Philadelphia, Pa.
Jamison Cold Storage Door Co., Hagerstown, Md.
Schoellkopf Mfg. Co., Madison, Wis.
Streator Products Corp., Fairfield, Iowa.
A. H. Witt Co., Los Angeles, Calif.
York Corp., York, Pa.

DOOR GASKETS, COLD STORAGE

Armstrong Cork Co., Lancaster, Pa.
Butcher Boy Refrigerator Door Co., Chicago, Ill.
Chase Cold Storage Door Co., Reading, Ohio.
Chase Industrial Refrigeration Equipment Co., Reading, Ohio.
Chemsol, Inc., Elizabeth, N.J.
Garlock Packing Co., Palmyra, N.Y.
Great American Industries, Bedford, Va.
R. G. Hemmick & Sons, St. Louis, Mo.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Jamison Cold Storage Door Co., Hagerstown, Md.
Jarvis Products, Inc., Chicago, Ill.
Johns-Manville Corp., New York, N.Y.
John H. Mennet, Inc., St. Albans, N.Y.
Streator Products Corp., Fairfield, Iowa.
York Corp., York, Pa.

DOORS, COLD STORAGE

Advanced Engineering Corp., Milwaukee, Wis.
American Pipe & Freezer Corp., E. Boston, Mass.
Ballard Sales Co., Fort Worth, Texas.
Bell Ice Corp., Seattle, Wash.
Butcher Boy Refrigerator Door Co., Chicago, Ill.
Center Engineering Co., Montclair, N.J.
Chase Cold Storage Door Co., Reading, Ohio.
Chase Industrial Refrigeration Equipment Co., Reading, Ohio.
Clark Door Co., Inc., Newark, N.J.
Dole Refrigerating Co., Chicago, Ill.
Jamison Cold Storage Door Co., Hagerstown, Md.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
LaCrosse Cooler Co., LaCrosse, Wis.
Mendel Cork Corp., North Bergen, N.J.
Refrigeration Engineering Co., Minneapolis, Minn.
Streator Products Corp., Fairfield, Iowa
Stic-Klip Mfg. Co., Cambridge, Mass.
A. H. Witt Co., Los Angeles, Calif.
York Corp., York, Pa.

DOORS, FIREPROOF

York Corp., York, Pa.

DRIERS (See Dehydrants)

DRINKING WATER COOLING PLANTS

Water Treatment Engineering, Cleveland, Ohio.
Worthington Corp., Harrison, N.J.

DRIP PANS (See Pans, Drip)

DRIVES AND COUPLINGS

Bailey Meter Co., Cleveland, Ohio
Browning Mfg. Co., Maysville, Ky.
Electric Machinery Mfg. Co., Minneapolis, Minn.
General Electric Co., Schenectady, N.Y.
Kohlenberger Engineering Co., Fullerton, Calif.
Koppers Company, Inc., Pittsburgh, Pa.
Link-Belt Co., Chicago, Ill.
Morse Mfg. Corp., Chicago, Ill.
Reliance Electric & Engineering Co., Cleveland, Ohio.
Worthington Corp., Harrison, N.J.

DRIVES, CHAIN (See Conveyors and Components)

DRYING EQUIPMENT, AIR OR GASEOUS PHASE

Dryomatic Corp., Alexandria, La.
Kohlenberger Engineering Co., Fullerton, Calif.

DUCT ACCESSORIES AND FITTINGS, PREFABRICATED DUCTWORK

Flexible Tubing Corp., Guilford, Conn.
Miracle Adhesives Corp., New York, N.Y.

DUCT INSULATION AND LINING (See Insulation)

ECONOMIZERS, AMMONIA

Hoven Ice Machine Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kohlenberger Engineering Co., Fullerton, Calif.
J. E. Watkins Co., Maywood, Ill.
Wolf Condenser Works, Brooklyn, N.Y.
York Corp., York, Pa.

EJECTORS (See Also Steam Jet Vacuum Cooling Systems)

Croll-Reynolds Co., New York, N.Y.
Elliott Co., Jeannette, Pa.
Schutte & Koerting Co., Cornwells Heights, Pa.
F. J. Stokes Machine Co., Philadelphia, Pa.
Worthington Corp., Harrison, N.J.

ELECTRIC GENERATING PLANTS, DIESEL OR GASOLINE DRIVEN (See Also Motor Generator Sets)

Allis-Chalmers, Buda Division, Harvey, Ill.
Caterpillar Tractor Co., Peoria, Ill.
Clark Bros. Co., Olean, N.Y.
Fairbanks, Morse & Co., Chicago, Ill.
Detroit Diesel Eng. Div. of General Motors Corp., Detroit, Mich.
Hallett Mfg. Co., Inglewood, Calif.
Harnischfeger Corp., Milwaukee, Wis.
Ready Power Co., Detroit, Mich.

ELECTRIC HEATER ELEMENTS (See Heater Elements)

ELECTRIC HOISTS (See Cranes & Hoists)

ELECTRIC LINE EQUIPMENT

Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
General Electric Co., Schenectady, N.Y.
Marion Electrical Instrument Co., Manchester, N.Y.
Miracle Adhesive Corp., New York, N.Y.
Westinghouse Electric Corp., Pittsburgh, Pa.

ELEVATORS

Gifford-Wood Co., Hudson, N.Y.
Link Belt Co., Chicago, Ill.

ENGINEERS (See Consulting Engineers)

ENGINES, DIESEL AND ACCESSORIES

Allis-Chalmers, Buda Div., Harvey, Ill.
Caterpillar Tractor Co., Peoria, Ill.
Clark Bros. Co., Olean, N.Y.
Continental Motors Corp., Muskegon, Mich.
Detroit Controls Corp., Detroit, Mich.
Hallett Mfg. Co., Inglewood, Calif.
Hercules Motors Corp., Canton, Ohio
R. H. Sheppard Co. Inc., Hanover, Pa.
Worthington Corp., Harrison, N.J.

ENGINES, GAS AND GASOLINE AND ACCESSORIES

Allis-Chalmers, Buda Div., Harvey, Ill.
Caterpillar Tractor Co., Peoria, Ill.
Clark Bros. Co., Olean, N.Y.
Continental Motors Corp., Muskegon, Mich.
Hercules Motors Corp., Canton, Ohio.
Worthington Corp., Harrison, N.J.

ENGINES, STEAM

Clark Bros. Co., Olean, N.Y.
Vilter Mfg. Co., Milwaukee, Wis.

EVAPORATIVE COOLERS AND ACCESSORIES

Air-Perma-Aire Mfg. Co., Paterson, N.J.
Baltimore Aircoil Co. Inc., Baltimore, Md.
Bell & Gossett Co., Morton Grove, Ill.
Dunham-Bush, Inc., West Hartford, Conn.
Kuhlenberger Engineering Co., Fullerton, Calif.
Marlo Coil Co., St. Louis, Mo.
Niagara Blower Co., New York, N.Y.
Trane Co., LaCrosse, Wis.
U. S. Air Conditioning Corp., Philadelphia, Pa.
Wolf Condenser Works, Brooklyn, N.Y.
Worthington Corp., Harrison, N.J.
York Corp., York, Pa.

EVAPORTAORS (See Coils, Fans, etc.)

EXPANSION VALVES

Aircraft Production Engineers, Chicago, Ill.
Alco Valve Co., St. Louis, Mo.
Allen-Bradley Co., Milwaukee, Wis.
A. P. Controls Co., Milwaukee, Wis.
Bailey Meter Co., Cleveland, Ohio.
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Sterling Instrument Co., Chatham, N.J.
A. W. Cash Valve Mfg. Corp., Decatur, Ill.
Dorsch, Gezowitz & Nowert, Inc., Chicago, Ill.
Detroit Controls Corp., Detroit, Mich.
Fielden Instrument Div., Robertshaw-Fulton Controls Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Frick Co., Waynesboro, Pa.
Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Knoxville, Tenn.
General Electric Co., Schenectady, N.Y.
Henry Valve Co., Melrose Park, Ill.
Hubbell Corp., Honolulu, Ill.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Johnson Service Co., Milwaukee, Wis.
Marcold Corp., Chicago, Ill.
Partlow Corp., New Hartford, N.Y.
H. A. Phillips & Co., Chicago, Ill.
Refrigerating Specialties Co., Chicago, Ill.
Schaefer & Koerting Co., Cornwells Heights, Pa.
Sporlan, Inc., Boston, Mass.
Cyrus Shank Co., Chicago, Ill.
Sherlan Valve Co., St. Louis, Mo.
Tenney Engineering Inc., Union, N.J.
Trane Co., LaCrosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
Henry Vogt Machine Co., Louisville, Ky.
J. E. Weldon Co., Maywood, Ill.
York Corp., York, Pa.

FANS

American Air Filter Co., Louisville, Ky.
Buffalo Co., Winston-Salem, N.C.
Brundage Co., Kalamazoo, Mich.
Carrier Corp., Syracuse, N.Y.
Chicago Blower Corp., Franklin Park, Ill.
Claage Fan Co., Kalamazoo, Mich.
Clark Bros. Co., Olean, N.Y.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Kuhlenberger Engineering Co., Fullerton, Calif.
Massey Mfg. Corp., Chicago, Ill.
Niagara Blower Co., New York, N.Y.
J. F. Pritchard & Co. of California, Kansas City, Mo.
Reynolds Electric Co., River Grove, Ill.
Robbins & Myers, Inc., Springfield, Ohio.
Roots Connersville Blower Div., Dresser Industries, Inc., Connersville, Ind.
Tenney Engineering Inc., Union, N.J.
Trane Co., LaCrosse, Wis.
United States Hoffman Corp., New York, N.Y.
U. S. Air Conditioning Corp., Philadelphia, Pa.

FELT, WATERPROOF (See Insulation)

FIBERGLAS (See Insulation)

FILTERS, AIR

Air-Perma-Aire Mfg. Co., Paterson, N.J.
American Air Filter Co., Louisville, Ky.
Automatic Switch Co., Orange, N.J.
Barneby-Cheney Company, Columbus, Ohio
Brundage Co., Kalamazoo, Mich.
Commercial Filters Corp., Melrose, Mass.
Conner Engineering Corp., Danbury, Conn.
Fisher Governor Co., Marshalltown, Iowa.
Mann-Nelles Regulator Co., Norwood, Mass.
Research Products Corp., Madison, Wis.
York Corp., York, Pa.

FILTERS, MAGNETIC

Commercial Filters Corp., Melrose, Mass.
United States Hoffman Corp., New York, N.Y.

FILTERS, OIL, WATER

A. P. Controls Corp., Milwaukee, Wis.
Automatic Switch Co., Orange, N.J.
Barneby-Cheney Co., Columbus, Ohio
A. W. Cash Valve Mfg. Corp., Decatur, Ill.
Chemical Engineering Co. Inc., Dallas, Texas.
Commercial Filters Corp., Melrose, Mass.
Filtrine Mfg. Co., Brooklyn, N.Y.
Fisher Governor Co., Marshalltown, Iowa.
Ice Plant Equipment Co., Inc., Philadelphia, Pa.
Permutit Co., New York, N.Y.
United States Hoffman Corp., New York, N.Y.
York Corp., York, Pa.

FILTERS, REFRIGERANT

A. P. Controls Corp., Milwaukee, Wis.
Automatic Switch Co., Orange, N.J.
Commercial Filters Corp., Melrose, Mass.
Henry Valve Co., Melrose Park, Ill.
H. A. Phillips & Co., Chicago, Ill.
Refrigerating Specialties Co., Chicago, Ill.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

FILTRATION EQUIPMENT

American Air Filter Co., Louisville, Ky.
Barneby-Cheney Co., Columbus, Ohio.
Commercial Filters Corp., Melrose, Mass.
Filtrine Mfg. Co., Brooklyn, N.Y.
Permutit Co., New York, N.Y.
Trane Co., LaCrosse, Wis.
United States Hoffman Corp., New York, N.Y.

FINNED COILS (See Coils, Fin)

FINISHES

Armstrong Cork Co., Lancaster, Pa.
Barrett Smith-Painter Co., Providence, R.I.
Camp Co. Inc., Chicago, Ill.
Carbolineum Wood Preserving Co., Milwaukee, Wis.
Chemical Solvent Co., Birmingham, Ala.
Coating Laboratories, Inc., Toledo, Ohio.
Coastal Laboratories, New York, N.Y.
Chemical Div., Calvidon Corp., New York, N.Y.
Alfred Hague & Co. Inc., Brooklyn, N.Y.
A. C. Horn Div., Sun Chemical Corp., Long Island, N.Y.
MBMI, Inc., Houston, Texas.
National Cork Co., Englewood, N.J.
E. H. O'Neill Floors Co., Cicero, Ill.
Pinkney Co. Inc., New York, N.Y.
Tropical Paint Co., Cleveland, Ohio.
Tuferete Co. Inc., Des Moines, Iowa.
Wilbur & Williams Co., Brighton, Boston, Mass.

FIRE PROTECTION EQUIPMENT

Ansul Chemical Co., Marinette, Wis.
Columbia Southern Chemical Corp., Pittsburgh, Pa.
Exide Industrial Div., Electric Storage Battery Co., Philadelphia, Pa.
Grinnell Company, Providence, R.I.

FITTINGS, AMMONIA

Aircraft Production Engineers, Chicago, Ill.
Automatic Switch Co., Orange, N.J.
Crane Company, Chicago, Ill.
Dorsch, Gezowitz & Nowert, Inc., Chicago, Ill.
Frick Co., Waynesboro, Pa.
Henry Valve Co., Melrose Park, Ill.
Hubbell Corp., Honolulu, Ill.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Jorgensen Steel & Valve Co., Somerville, Mass.
Kuhlenberger Engineering Co., Fullerton, Calif.
Ludish Co., Cudahy, Wis.
Mojonnier Bros. Chicago, Ill.
Cyrus Shank Co., Chicago, Ill.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
Henry Vogt Machine Co., Louisville, Ky.
J. E. Weldon Co., Maywood, Ill.
York Corp., York, Pa.

FITTINGS, ELECTRICAL (See Electrical Line Equipment)

FITTINGS, HOSE

Bund-It Co., Denver, Colo.
Flexible Tubing Corp., Guilford, Conn.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Superior Valve & Fittings Co., Pittsburgh, Pa.
United States Hoffman Corp., New York, N.Y.

FITTINGS, REFRIGERANT

Aircraft Production Engineers, Chicago, Ill.
Bohannan & Wilcox Co., Beaver Falls, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Dorsch, Gezowitz & Nowert, Inc., Chicago, Ill.
Frick Co., Waynesboro, Pa.
Henry Valve Co., Melrose Park, Ill.
Grinnell Company, Providence, R.I.
Jorgensen Steel & Valve Co., Somerville, Mass.
Ludish Co., Cudahy, Wis.
Cyrus Shank Co., Chicago, Ill.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
Henry Vogt Machine Co., Louisville, Ky.
Worthington Corp., Harrison, N.J.
York Corp., York, Pa.

FLAKE ICE MACHINES (See Ice Making Machines)

FLEXIBLE CONNECTIONS (See Charging Lines)

FLEXIBLE COUPLINGS (See Drives and Couplings)

FLOATS, CONTROLS, SWITCHES (See Controls)

FLOAT VALVES (See Controls, Float Valve)

FLOORING MATERIALS

Camp Co., Inc., Chicago, Ill.
Alfred Hague & Co. Inc., Brooklyn, N.Y.
Johns-Manville Corp., N.Y.
Mahogany Importing Co., Los Angeles, Calif.
E. H. O'Neill Floor Co., Cicero, Ill.
Permanite Corp., Chicago, Ill.
Tuferete Co. Inc., Des Moines, Iowa.

FLOW CONTROLS (See Regulators, Flow)

FOIL, METALLIC

FOOD FREEZING EQUIPMENT (See Freezers, etc.)

FOOD PROCESSING MACHINERY

Aircraft Production Engineers, Chicago, Ill.
Kuhlenberger Engineering Co., Fullerton, Calif.
Mojonnier Bros. Co., Chicago, Ill.
Reynolds Electric Co., River Grove, Ill.
Wilder Mfg. Co. Inc., Port Jervis, N.Y.

FORK LIFT TRUCKS (See Also Materials Handling)

FREEZER DOORS (See Doors, Cold Storage)

FREEZERS, BATCH, BLAST, CONTINUOUS, PACKAGE, QUICK, SHARP, TUNNEL, PORTABLE

Alpine Electric Refrigeration Co., Detroit, Mich.
Aircraft Production Engineers, Chicago, Ill.
American Plate Freezer Corp., E. Boston, Mass.
Belt-Ice Corp., Seattle, Wash.
Carrier Corp., Syracuse, N.Y.
Creamery Package Mfg. Co., Chicago, Ill.
Dean Products, Inc., Brooklyn, N.Y.
Dole Refrigerating Co., Chicago, Ill.
Freezing Equipment Sales, Inc., York, Pa.
Kuhlenberger Engineering Co., Fullerton, Calif.
Kramer Trenton Co., Trenton, N.J.
Kelvinator, Inc., Minneapolis, Minn.
Nor-Lake Inc., Hudson, Wis.
V. C. Patterson & Associates, Philadelphia, Pa.
Refrigeration Engineering Co., Minneapolis, Minn.
Refrigeration Engineering, Inc., Los Angeles, Calif.
S & S Vending Machine Co., San Jose, Calif.
Tronter Mfg. Inc., Lansing, Mich.
Vilter Mfg. Co., Milwaukee, Wis.
J. E. Weldon Co., Maywood, Ill.
York Corp., York, Pa.

FREEZERS, ICE CREAM (See Ice Cream Freezers)

FREEZING SYSTEMS

Advanced Engineering Corp., Milwaukee, Wis.
Aircraft Production Engineers, Chicago, Ill.
Alpine Electric Refrigeration Co., Detroit, Mich.
Belt-Ice Corp., Seattle, Wash.
Carrier Corp., Syracuse, N.Y.
Creamery Package Mfg. Co., Chicago, Ill.
Dunham-Bush, Inc., West Hartford, Conn.
Fielden Corp., Brooklyn, N.Y.
Freezing Equipment Sales, Inc., York, Pa.
Gay Engineering Corp., Los Angeles, Calif.
Hoyt Ice Machine Co., Chicago, Ill.
King Company, Owatonna, Minn.
Kuhlenberger Engineering Co., Fullerton, Calif.

Kramer Trenton Co., Trenton, N.J.
Marlo Coil Co., St. Louis, Mo.
V. C. Patterson & Associates, Philadelphia, Pa.
Refrigeration Engineering, Inc., Los Angeles, Calif.
Tranter Mfg. Inc., Lansing, Mich.
Vilter Mfg. Co., Milwaukee, Wis.
J. E. Watkins Co., Maywood, Ill.
York Corp., York, Pa.

FREEZING TANKS (See Also Brine Tanks)

Aircraft Production Engineers, Chicago, Ill.
Dean Products, Inc., Brooklyn, N.Y.
Dole Refrigerating Co., Chicago, Ill.
Vogt Ice Machine Co., Chicago, Ill.
Ice Plant Equipment Co., Inc., Philadelphia, Pa.
King Zero Co., Chicago, Ill.
Kohlenberger Engineering Co., Fullerton, Calif.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

"FREONS" (See Refrigerants)

FRICTION TAPE (See Also Insulation Accessories and Adhesives)

FROZEN FOOD LOCKERS

S & S Vending Machine Co., San Jose, Calif.
Stic-Klip Mfg. Co., Cambridge Mass.
York Corp., York, Pa.

FUSIBLE PLUGS

Lunkenheimer Co., Cincinnati, Ohio
Superior Valve & Fittings Co., Pittsburgh, Pa.

GALVANIZING

Chemical Div., Gabriola Corp., New York, N.Y.
Coastal Laboratories, New York, N.Y.
Ohio Galvanizing & Mfg. Co., Niles, Ohio
Rotometals, San Francisco, Calif.

GAS COOLERS (See Heat Exchangers)

GAS MASKS (See Safety Appliances)

GASKETS AND GASKET MATERIALS, PACKING

Crane Packing Co., Chicago, Ill.
Garlock Packing Co., Palmyra, N.Y.
E. F. Houghton & Co., Philadelphia, Pa.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Johns-Manville Corp., New York, N.Y.
Mundet Cork Corp., North Bergen, N.J.
York Corp., York, Pa.

GASKETS, DOOR (See Door Gaskets, Cold Storage)

GAUGE GLASSES, ACCESSORIES

Jerguson Gage & Valve Co., Somerville, Mass.
Cyrus Shank Co., Chicago, Ill.
Uehling Instrument Co., Paterson, N.J.
York Corp., York, Pa.

GAUGES, AIR FILTER; DRAFT, DUCT PRESSURE

Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, Ohio
Bristol Co., Waterbury, Conn.
Marlan Instrument Co., Cleveland, Ohio
Uehling Instrument Co., Paterson, N.J.
Vilter Mfg. Co., Milwaukee, Wis.

GAUGES, INDICATING: COMPOUND, PRESSURE, VACUUM, RECORDING

American Machine & Metals, Inc., Sellersville, Pa.
Bailey Meter Co., Cleveland, Ohio
Bristol Co., Waterbury, Conn.
Fielden Instrument Div., Robertshaw Fulton Controls Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Hastings Instrument Co. Inc., Hampton, Va.
Hobbell Corp., Mendelein, Ill.
Instrument & Gauge Div., Electric Auto-Lite Co., Toledo, Ohio
Johnson Service Co., Milwaukee, Wis.
James P. Marsh Corp., Skokie, Ill.
Mason-Neilan Regulator Co., Norwood, Mass.
Marlan Instrument Co., Cleveland, Ohio
Rochester Mfg. Co. Inc., Rochester, N.Y.
F. J. Stokes Machine Co., Philadelphia, Pa.
Taylor Instrument Companies, Rochester, N.Y.
Uehling Instrument Co., Paterson, N.J.

GAUGES, LIQUID LEVEL, TANK, ETC.

Atlas Valve Co., Newark, N.J.
Bailey Meter Co., Cleveland, Ohio
Bristol Co., Waterbury, Conn.
Fielden Instrument Div., Robertshaw-Fulton Controls Co., Philadelphia, Pa.
Fisher Governor Co., Marshalltown, Iowa
Foxboro Co., Foxboro, Mass.
Frenting Equipment Sales, Inc., York, Pa.
Henry Valve Co., Melrose Park, Ill.
Jerguson Gage & Valve Co., Somerville, Mass.
Lunkenheimer Co., Cincinnati, Ohio
Marlan Instrument Co., Cleveland, Ohio
H. A. Phillips & Co., Chicago, Ill.
Rochester Mfg. Co., Inc., Rochester, N.Y.
Cyrus Shank Co., Chicago, Ill.
Trane Co., LaCrosse, Wis.
Uehling Instrument Co., Paterson, N.J.
Henry Vogt Machine Co., Louisville, Ky.
York Corp., York, Pa.

GEARS

Link-Belt Co., Chicago, Ill.
R. H. Sheppard Co. Inc., Hanover, Pa.

GENETRON (See Refrigerants)

GLASS, INSULATING OR HEAT DEFLECTING

GLYCOLS

Barada & Page, Inc., Kansas City, Mo.
Dow Chemical Co., Midland, Mich.
Linde Air Products Co., New York, N.Y.

GRANULATED CORK (See Insulation)

GREASE (See Lubricants)

GRILLES

Ascenostat Corp. of America, New York, N.Y.
Bahnson Co., Winston-Salem, N.C.
Barber-Colman Co., Rockford, Ill.
Connor Engineering Corp., Danbury, Conn.
Tuttle & Bailey, Inc., New Britain, Conn.
Vilter Mfg. Co., Milwaukee, Wis.

HAIR FELT INSULATION (See Insulation)

HAND TRUCKS (See Materials Handling Equipment)

HARDENING ROOMS (See Refrigerators, Sectional, etc.)

HEAT EXCHANGERS (See Also Pressure Vessels)

Acme Industries, Inc., Jackson, Mich.
Agric Machinery Corp., New York, N.Y.
Alpha Electric Refrigeration Co., Detroit, Mich.
Richard M. Armstrong Co., West Chester, Pa.
Bell & Gossett Co., Morton Grove, Ill.
Buxton Mfg. Co., Dover, N.J.
Carrier Corp., Syracuse, N.Y.
Creamery Package Mfg. Co., Chicago, Ill.
Dean Products, Inc., Brooklyn, N.Y.
Doyle & Roth Mfg. Co. Inc., Brooklyn, N.Y.
Dreyer-Hanson, Inc., Los Angeles, Calif.
Heatron, Inc., York, Pa.
Heat-X, Inc., Brewster, N.Y.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kohlenberger Engineering Co., Fullerton, Calif.
Kramer Trenton Co., Trenton, N.J.
Marlo Coil Co., St. Louis, Mo.
Mojonnier Bros. Co., Chicago, Ill.
National Pipe Bending Co., New Haven, Conn.
Niagara Blower Co., New York, N.Y.
Patterson-Kelley Co. Inc., East Stroudsburg, Pa.
Recey Products Co., Canton, Ohio
Reesing Mfg. Co., Pittsburgh, Pa.
Schutte & Koerting Co., Cornwells Heights, Pa.
R. H. Sheppard Co. Inc., Hanover, Pa.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Taco Heaters, Inc., Providence, R.I.
Trane Co., LaCrosse, Wis.
Tranter Mfg. Inc., Lansing, Mich.
Vilter Mfg. Co., Milwaukee, Wis.
Henry Vogt Machine Co., Louisville, Ky.
J. E. Watkins Co., Maywood, Ill.
Whitlock Mfg. Co., West Hartford, Conn.
Wolf Condenser Works, Brooklyn, N.Y.
Worthington Corp., Harrison, N.J.
York Corp., York, Pa.
Young Radiator Co., Racine, Wis.

HEAT PUMPS, SELF CONTAINED

Acme Industries, Inc., Jackson, Mich.
American Coils Co., Newark, N.J.
Carrier Corp., Syracuse, N.Y.
Heat-X, Inc., Brewster, N.Y.
Trane Co., LaCrosse, Wis.
York Corp., York, Pa.

HEAT ELEMENTS (See Also Defrosting Systems)

Acra Electric Corp., Franklin Park, Ill.
Heatron, Inc., York, Pa.
Industrial Mfg. & Engineering Co., Chicago, Ill.
John H. Marcott, Inc., St. Albans, N.Y.
Streator Products Corp., Fairfield, Iowa

HEATING COILS (See Also Coils by Type)

Acra Electric Corp., Franklin Park, Ill.
American Air Filter Co., Louisville, Ky.
Chicago Pan Co., Kalamazoo, Mich.
Dean Products, Inc., Brooklyn, N.Y.
Heatron, Inc., York, Pa.
Kennard Corp., St. Louis, Mo.
McQuay, Inc., Minneapolis, Minn.
Marlo Coil Co., St. Louis, Mo.
National Pipe Bending Co., New Haven, Conn.
Refrigeration Engineering, Inc., Los Angeles, Calif.
Bunning Mfg. Co., Pittsburgh, Pa.
Tenney Engineering, Inc., Union, N.J.
Trane Co., LaCrosse, Wis.
Tranter Mfg. Inc., Lansing, Mich.
York Corp., York, Pa.

HOISTS (See Cranes)

HOSE

Flexible Tubing Corp., Guilford, Conn.
Flexonics Corp., Maywood, Ill.
Gates Rubber Co., Denver, Colo.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Vibration Mountings, Corona, N.Y.

HOSE CLAMPS (See Fittings, Hose)

HUMIDIFYING SYSTEMS (See Also Dehumidifying Systems)

Air-Power-Ator Mfg. Co., Paterson, N.J.
Alpha Electric Refrigeration Co., Detroit, Mich.
Armstrong Machine Works, Three Rivers, Mich.
Bahnson Co., Winston-Salem, N.C.
Barber-Colman Co., Rockford, Ill.
Blaisdell Manufacturing Co., Chicago, Ill.
Carrier Corp., Syracuse, N.Y.
Clarage Fan Co., Kalamazoo, Mich.
Foxboro Co., Foxboro, Mass.
Grinnell Company, Providence, R.I.
Hubbell Corp., Mendelein, Ill.
Johnson Service Co., Milwaukee, Wis.
Mold-O-Mist, Inc., Chicago, Ill.
Marlo Coil Co., St. Louis, Mo.
John H. Marcott, Inc., St. Albans, N.Y.
Niagara Blower Co., New York, N.Y.
Parks Cramer Co., Fitchburg, Mass.
Portion Corp., New Hartford, N.Y.
Powers Regulator Co., Skokie, Ill.
Refrigerating Specialties Co., Chicago, Ill.
Research Products Corp., Madison, Wis.
Sardee, Inc., Boston, Mass.
Spraying Systems Co., Bellwood, Ill.
Trane Co. LaCrosse, Wis.
Water Cooling Corp., New York, N.Y.
Worthington Corp., Harrison, N.J.
York Corp., York, Pa.

ICE BLOWERS AND CRUSHERS

Ballard Sales Co., Fort Worth, Texas
Bateman Foundry & Machine Co., Inc., Mineral Wells, Texas
Gifford-Wood Co., Hudson, N.Y.
Hall Machine Shop, New Smyrna Beach, Fla.
Ice Plant Equipment Co., Inc., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.
Franklin P. Misner & Son, Inc., East Orange, N.J.

ICE BUILDERS, LATENT HEAT (See Accumulators)

ICE CAN DUMPS

Ballard Sales Co., Fort Worth, Texas
Frick Co., Waynesboro, Pa.
Gifford-Wood Co., Hudson, N.Y.
Hall Machine Shop, New Smyrna Beach, Fla.
Ice Plant Equipment Co., Inc., Philadelphia, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

ICE CAN FILLERS

Ballard Sales Co., Fort Worth, Texas
Frick Co., Waynesboro, Pa.
Hall Machine Shop, New Smyrna Beach, Fla.
Ice Plant Equipment Co., Inc., Philadelphia, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

ICE CAN HOISTS (See Cranes & Hoists)

ICE CANS

Ballard Sales Co., Fort Worth, Texas
Frick Co., Waynesboro, Pa.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Ohio Galvanizing & Mfg. Co., Niles, Ohio
York Corp., York, Pa.

ICE CONVEYORS (See Conveyors and Components)

ICE CREAM FREEZERS

Creamery Package Mfg. Co., Chicago, Ill.
Freezing Equipment Sales, Inc., York, Pa.
Franklin P. Misner & Son, Inc., East Orange, N.J.
Nor-Lake, Inc., Hudson, Wis.
Refrigerating Engineering Inc., Los Angeles, Calif.

ICE CREAM HARDENING ROOMS (See Refrigerators, Sectional, Etc.)

ICE CUBE MACHINES (See Also Ice Making Machines)

Aircraft Production Engineers, Chicago, Ill.
Carrier Corp., Syracuse, N.Y.
Flynn and Emrich Co., Baltimore, Md.
LaCrosse Cooler Co., LaCrosse, Wis.
Lipman Div., Yates American Machine Co., Beloit, Wis.
McQuay, Inc., Minneapolis, Minn.
Nor-Lake, Inc., Hudson, Wis.

Wagner Mfg. Co., Charlotte, N.C.
York Corp., York, Pa.

ICE HANDLING MACHINERY AND ACCESSORIES

American Ice Machinery & Equip. Co., Philadelphia.
Ballard Sales Co., Fort Worth, Texas
Fiskio Corp., Brooklyn, N.Y.
Gifford-Wood Co., Hudson, N.Y.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Lilly Co., Memphis, Tenn.
Link-Belt Co., Chicago, Ill.
Ohio Scientific & Mfg. Co., Niles, Ohio
York Corp., York, Pa.

ICE MAKING MACHINES

Aircraft Production Engineers, Chicago, Ill.
American Ice Machinery & Equip. Co. Philadelphia.
Belt-Ice Corp., Seattle, Wash.
Carrier Corp., Syracuse, N.Y.
Cal-Flake Corp., Chicago, Ill.
Darnell, Gennels & Hewitt, Chicago, Ill.
Fiskio Corp., Brooklyn, N.Y.
Frick Co., Waynesboro, Pa.
Howe Ice Machine Co., Chicago, Ill.
Kelvinator Engineering Co., Fullerton, Calif.
LaCrosse Cooler Co., LaCrosse, Wis.
McDonough Inc., Minneapolis, Minn.
Vilter Mfg. Co., Milwaukee, Wis.
Worthington Corp., Harrison, N.J.
York Corp., York, Pa.

ICE SCORING MACHINES

Ballard Sales Co., Fort Worth, Texas
Gifford-Wood Co., Hudson, N.Y.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Perfection Ice Scoring Machine Co., Fort Worth, Texas
York Corp., York, Pa.

ICE VENDING STATIONS (See Vending Stations, Ice)

INHIBITORS (See Water Treating Materials)

INJECTORS

H. A. Phillips & Co., Chicago, Ill.
Schutte & Koerting Co., Cornwells Heights, Pa.

INSTRUMENT PANELS

Automatic Temperature Control Co., Philadelphia, Pa.
Bailey Meter Co., Cleveland, Ohio
Bristol Co., Waterbury, Conn.
Fedders Co., Fedders, Mass.
Kelvinator Engineering Co., Fullerton, Calif.
Leeds and Northrup Co., Philadelphia, Pa.
Minne-Motion Regulator Co., Norwood, Mass.
Minneld Corp., Chicago, Ill.
Powers Regulator Co., Skokie, Ill.
Taylor Instrument Companies, Rochester, N.Y.
Uehling Instrument Co., Paterson, N.J.
Weston Electrical Instrument Corp., Newark, N.J.

INSTRUMENTS, INDICATING

American Machine & Metals, Inc., Sellersville, Pa.
Automatic Temperature Control Co., Philadelphia, Pa.
Bailey Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, Ohio
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Fiskio Instrument Div., Robertshaw-Fulton Controls Co., Philadelphia, Pa.
Fedders Co., Fedders, Mass.
General Controls Co., Glendale, Calif.
General Electric Co., Schenectady, N.Y.
Hastings Instrument Co. Inc., Hampton, Va.
Instrument & Gauge Div., Electric Auto-Lite Co., Toledo, Ohio
J-B-T Instruments, Inc., New Haven, Conn.
Jorgensen Gage & Valve Co., Somerville, Mass.
Johnson Service Co., Milwaukee, Wis.
Leeds and Northrup Co., Philadelphia, Pa.
Marion Electrical Instrument Co., Manchester, N.H.
James P. Marsh Corp., Skokie, Ill.
Minne-Motion Regulator Co., Norwood, Mass.
Mueller Instrument Co. Inc., Richmond Hill, N.Y.
Powers Regulator Co., Skokie, Ill.
Rochester Mfg. Co. Inc., Rochester, N.Y.
Schutte & Koerting Co., Cornwells Heights, Pa.
Sorgen Inc., Boston, Mass.
Taylor Instrument Companies, Rochester, N.Y.
Trane Co., LaCrosse, Wis.
Uehling Instrument Co., Paterson, N.J.
Weston Electrical Instrument Corp., Newark, N.J.

INSTRUMENTS, RECORDING

American Machine & Metals, Inc., Sellersville, Pa.
Automatic Temperature Control Co., Philadelphia, Pa.
Bailey Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, Ohio
Ballard Sales Co., Fort Worth, Texas
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Fedders Co., Fedders, Mass.
General Controls Co., Glendale, Calif.
General Electric Co., Schenectady, N.Y.
Hubbell Corp., Manchester, Ill.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Instrument & Gauge Div., Electric Auto-Lite Co., Toledo, Ohio
Johnson Service Co., Milwaukee, Wis.
Leeds and Northrup Co., Philadelphia, Pa.
James P. Marsh Corp., Skokie, Ill.
Mason-Neilan Regulator Co., Norwood, Mass.
Moeller Instrument Co., Inc., Richmond Hills, N.Y.
John H. Merrell, Inc., St. Albans, N.Y.
Pacific Transducer Corp., Los Angeles, Calif.
Partlow Corp., New Hartford, N.Y.
Powers Regulator Co., Skokie, Ill.
Rochester Mfg. Co. Inc., Rochester, N.Y.
Schutte & Koerting Co., Cornwells Heights, Pa.
Sorgen Inc., Boston, Mass.
Taylor Instrument Companies, Rochester, N.Y.
Trane Co., LaCrosse, Wis.
Uehling Instrument Co., Paterson, N.J.
Weston Electrical Instrument Corp., Newark, N.J.

INSULATION

Aluminoil Corp., New York, N.Y.
American Hair & Felt Co., Chicago, Ill.
Armstrong Cork Co., Lancaster, Pa.
Baldwin-Hill Co., Trenton, N.J.
Philip Carey Mfg. Co., Cincinnati, Ohio
Cornell Corp., Inc., Mankato, Minn.
Dow Chemical Co., Midland, Mich.
Great American Industries, Inc., Bedford, Va.
Isofoil Corp., San Francisco, Calif.
John-Manville Corp., New York, N.Y.
Kimble, Inc., Houston, Texas
Miracle Adhesives Corp., New York, N.Y.
J. W. Mortell Co., Kankakee, Ill.
Mundet Cork Corp., North Bergen, N.J.
Mystick Adhesive Products, Chicago, Ill.
National Cork Co., Englewood, N.J.
Owens-Corning Fiberglas Corp., Toledo, Ohio
Pacific Lumber Co., San Francisco, Calif.
Pittsburgh Corning Corp., Pittsburgh, Pa.
Prestite Engineering Co., St. Louis, Mo.
Quigley Co. Inc., New York, N.Y.
Sisc-Kilp Mfg. Co., Cambridge Mass.
Streator Products Corp., Fairfield, Iowa
Union Lumber Co., San Francisco, Calif.
United Cork Companies, Kearny, N.J.
York Corp., York, Pa.
Zonolite Co., Chicago, Ill.

INSULATION ACCESSORIES

Aluminoil Corp., New York, N.Y.
Armstrong Cork Co., Lancaster, Pa.
Baldwin-Hill Co., Trenton, N.J.
Dow Chemical Co., Midland, Mich.
John-Manville Corp., New York, N.Y.
Kimble, Inc., Houston, Texas
Miracle Adhesives Corp., New York, N.Y.
J. W. Mortell Co., Kankakee, Ill.
Mundet Cork Corp., North Bergen, N.J.
Prestite Engineering Co., St. Louis, Mo.
Quigley Co. Inc., New York, N.Y.
Sisc-Kilp Mfg. Co., Cambridge Mass.
United Cork Companies, Kearny, N.J.

INSULATION ADHESIVES (See Adhesives, Cements, etc.)

INSULATION FINISHES (See Adhesives, Cements, Compounds, Coatings)

INSULATION, REFLECTIVE

Aluminoil Corp., New York, N.Y.
Isofoil Corp., San Francisco, Calif.
Miracle Adhesives Corp., New York, N.Y.
Reflectal Corp., Chicago, Ill.

INSULATION, THERMAL HIGH TEMPERATURE

Armstrong Cork Co., Lancaster, Pa.
Baldwin-Hill Co., Trenton, N.J.
Philip Carey Mfg. Co., Cincinnati, Ohio
Cornell Co. Inc., Mankato, Minn.
John-Manville Corp., New York, N.Y.
Miracle Adhesives Corp., New York, N.Y.
Mundet Cork Corp., North Bergen, N.J.
Owens Corning Fiberglas Corp., Toledo, Ohio
Quigley Co., Inc., New York, N.Y.
Tiderider, Inc., Freeport, N.Y.
United Cork Companies, Kearny, N.J.
Zonolite Co., Chicago, Ill.

INSULATION, THERMAL LOW TEMPERATURE

Armstrong Cork Co., Lancaster, Pa.
Baldwin-Hill Co., Trenton, N.J.
Philip Carey Mfg. Co., Cincinnati, Ohio
Cornell Co. Inc., Mankato, Minn.
Great American Industries, Bedford, Va.
Isofoil Corp., San Francisco, Calif.
John-Manville Corp., New York, N.Y.
Kimble, Inc. Houston, Texas
Miracle Adhesives Corp., New York, N.Y.
Mundet Cork Corp., North Bergen, N.J.
National Cork Co., Englewood, N.J.
Owens-Corning Fiberglas Corp., Toledo, Ohio
Pacific Lumber Co., San Francisco, Calif.
Quigley Co., Inc., New York, N.Y.
Tiderider, Inc., Freeport, N.Y.
United Cork Companies, Kearny, N.J.
Zonolite Co., Chicago, Ill.

INSULATION, THERMAL: LOW TEMPERATURE, FORMS, FITTINGS, PIPE COVERINGS

Aluminoil Corp., New York, N.Y.
Armstrong Cork Co., Lancaster, Pa.
Baldwin-Hill Co., Trenton, N.J.
Philip Carey Mfg. Co., Cincinnati, Ohio
Dow Chemical Co., Midland, Mich.
Great American Industries, Bedford, Va.
John-Manville Corp., New York, N.Y.
Kimble, Inc., Houston, Texas
Miracle Adhesives Corp., New York, N.Y.
J. W. Mortell Co., Kankakee, Ill.
Mundet Cork Corp., North Bergen, N.J.
National Cork Co., Englewood, N.J.
Owens-Corning Fiberglas Corp., Toledo, Ohio
Prestite Engineering Co., St. Louis, Mo.
United Cork Companies, Kearny, N.J.

INSURANCE

Bruce Dodson & Co., Kansas City, Mo.

LARD CHILLERS (See Food Processing Machinery)

LATENT HEAT TANKS (See Pressure Vessels)

LEAK DETECTORS AND INDICATORS

Allin Manufacturing Co., Chicago, Ill.
Jastrite Mfg. Co., Chicago, Ill.
Velocity Power Tool Co., Pittsburgh, Pa.
York Corp., York, Pa.

LEATHER BELTING (See Belts and Belting)

LIFT TRUCKS (See Materials Handling)

LIQUID COOLERS

Acme Industries, Inc., Jackson, Mich.
Alpha Electric Refrigeration Co., Detroit, Mich.
American Coils Co., Newark, N.J.
Richard M. Armstrong Co., West Chester, Pa.
Bell & Gossett Co., Morton Grove, Ill.
Dole Refrigerating Co., Chicago, Ill.
Doyle & Roth Mfg. Co. Inc., Brooklyn, N.Y.
Kleenzoil Corp., St. Louis, Mo.
Kelvinator Engineering Co., Fullerton, Calif.
Recoy Products Co., Canton, Ohio
Schuette & Koerting, Cornwells Heights, Pa.
Temprite Products Corp., Birmingham, Mich.
Trane Co., LaCrosse, Wis.
Henry Vogt Machine Co., Louisville, Ky.
J. E. Weldon Co., Maywood, Ill.
Whitlock Mfg. Co., West Hartford, Conn.
Wolf Condenser Works, Brooklyn, N.Y.
York Corp., York, Pa.
Young Radiator Co., Racine, Wis.

LIQUID INDICATORS

Allin Manufacturing Co., Chicago, Ill.
Amsel Chemical Co., Marinette, Wis.
Fiskio Instrument Div., Robertshaw-Fulton Controls Co., Philadelphia, Pa.
Henry Valve Co., Melrose Park, Ill.
Jorgensen Gage & Valve Co., Somerville, Mass.
Kelvinator Engineering Co., Fullerton, Calif.
H. A. Phillips & Co., Chicago, Ill.
Schuette & Koerting Co., Cornwells Heights, Pa.
Dyrex Shank Co., Chicago, Ill.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Uehling Instrument Co., Paterson, N.J.
Virginia Smelting Co., West Norfolk, Va.

LIQUID LEVEL INDICATORS (See Gauges, Liquid Level)

LIQUID RECIRCULATING SYSTEMS

Aircraft Production Engineers, Chicago, Ill.
Kelvinator Engineering Co., Fullerton, Calif.
H. A. Phillips & Co., Chicago, Ill.
Trane Co., LaCrosse, Wis.
J. E. Weldon Co., Maywood, Ill.
York Corp., York, Pa.

LIQUID RETURN SYSTEM

Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Knoxville, Tenn.
Howe Ice Machine Co., Chicago, Ill.
Kelvinator Engineering Co., Fullerton, Calif.
H. A. Phillips & Co., Chicago, Ill.
Trane Co., LaCrosse, Wis.
J. E. Weldon Co., Maywood, Ill.
York Corp., York, Pa.

LITHIUM SALTS

American Potash & Chemicals Corp., Los Angeles, Calif.

LOW TEMPERATURE TEST CABINETS

Alpha Electric Refrigeration Co., Detroit, Mich.
Dean Products, Inc., Brooklyn, N.Y.
Harris Refrigeration Co., Cambridge, Mass.
Kelvinator Engineering Co., Fullerton, Calif.

McQuay, Inc., Minneapolis, Minn.
Tenney Engineering, Inc., Union, N.J.
York Corp., York, Pa.

LUBRICANTS, GRAPHITE, GREASE, OIL

Ansul Chemical Co., Marinette, Wis.
Armite Laboratories, Los Angeles, Calif.
E. F. Houghton & Co., Philadelphia, Pa.
Linde Air Products Co., New York, N.Y.
Sun Oil Co., Philadelphia, Pa.
Texas Company, New York, N.Y.
Virginia Smelting Co., West Norfolk, Va.
York Corp., York, Pa.

LUBRICATING OIL COOLERS (See Also Heat Exchangers)

Heat-X, Inc., Brewster, N.Y.
Whitlock Mfg. Co., West Hartford, Conn.
York Corp., York, Pa.
Young Radiator Co., Racine, Wis.

LUBRICATORS

Elliott Co., Newark, N.J.
York Corp., York, Pa.

LUMBER SPECIALTIES

Mahogany Importing Co., Los Angeles, Calif.
Sterling Lumber & Supply Co., Chicago, Ill.

MAGNESIUM CHLORIDE (See Water Treating Materials)

MAGNETIC VALVES (See Solenoid Valves)

MASKS, AMMONIA (See Safety Appliances)

MATERIALS HANDLING EQUIPMENT (See Also Fork Lift Trucks)

Acme Pallet Company, Inc., New York, N.Y.
Allis-Chalmers, Bulk Division, Harvey, Ill.
Ballard Sales Co., Fort Worth, Texas
Economy Engineering Co., Chicago, Ill.
Gifford-Wood Co., Hudson, N.Y.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Johns-Manville Corp., N.J.
Lewis-Shepard Products, Inc., Watertown, Mass.
Link Belt Co., Chicago, Ill.
Moto-Truc Co., Cleveland, Ohio
John H. Nesbitt, Inc., St. Albans, N.Y.
National Pallet Corp., Pittsburgh, Pa.
Ohio Galvanizing & Mfg. Co., Niles, Ohio
Pallets, Inc., New York, N.Y.
Pallets, Inc., Hudson Falls, N. Y.
Wilder Mfg. Co. Inc., Port Jervis, N.Y.

METALLIC PACKING (See Packings, Mechanical Metallic)

METERS, BRINE

METERS, ELECTRIC (See also Electrical Line Equipment)

Bristol Co., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.
J-B-T Instruments, Inc., New Haven, Conn.
Marion Electrical Instrument Co., Manchester, N.H.
Weston Electrical Instrument Corp., Newark, N.J.

METERS, FLOW: AIR, GAS, FLUIDS

Bailey Meter Co., Cleveland, Ohio
Bristol Co., Waterbury, Conn.
Inc., Conersville, Ind.
Foxboro Co., Foxboro, Mass.
Hastings Instrument Co. Inc., Hampton, Va.
Mason-Neilan Regulator Co., Norwood, Mass.
Merlam Instrument Co., Cleveland, Ohio
Roots Connersville Blower Div., Dresser Industries,
Schutte &Koerting Co., Cornwells Heights, Pa.

METHYL CHLORIDE (See Refrigerants)

MILK COOLERS (See Chillers and Coolers)

MOTOR BASES, BRACKETS AND SUPPORTS

Louis Allis Co., Milwaukee, Wis.
Ideal Electric & Mfg. Co., Mansfield, Ohio
Link Belt Co., Chicago, Ill.

MOTOR CONTROLS AND STARTERS

Allen-Bradley Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Electric Co., Hartford, Conn.
Automatic Switch Co., Orange, N. J.
Clark Controller Co., Cleveland, Ohio
Electric Controller & Mfg. Co., Cleveland, Ohio
Electric Machinery Mfg. Co., Minneapolis, Minn.
General Controls Co., Glendale, Calif.
General Electric Co., Schenectady, N.Y.
Heinemann Electric Co., Trenton, N.J.
Ideal Electric & Mfg. Co., Mansfield, Ohio
Mercoid Corp., Chicago, Ill.
Reynolds Electric Co., River Grove, Ill.
Westinghouse Electric Corp., Pittsburgh, Pa.
Weston Electrical Instrument Corp., Newark, N.J.

MOTOR, ELECTRIC PROTECTION DEVICES

Allen-Bradley Co., Milwaukee, Wis.
Clark Controller Co., Cleveland, Ohio
General Electric Co., Schenectady, N.Y.

MOTOR GENERATOR SETS

Louis Allis Co., Milwaukee, Wis.
Columbia Electric Mfg. Co., Cleveland, Ohio
Detroit Diesel Eng. Div., of General Motors Corp., Detroit, Mich.
Electric Machinery Mfg. Co., Minneapolis, Minn.
Elliott Co., Jeannette, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N.Y.
Harnischfeger Corp., Milwaukee, Wis.
Ideal Electric & Mfg. Co., Mansfield, Ohio
Reliance Electric & Engineering Co., Cleveland, Ohio
R. H. Sheppard Co. Inc., Hanover, Pa.
Star-Kimble Motor Div., Kimble Printing Press & Mfg. Co., Bloomfield, N.J.
Westinghouse Electric Corp., Pittsburgh, Pa.

MOTORS, ELECTRIC

Agric Machinery Corp., New York, N.Y.
Louis Allis Co., Milwaukee, Wis.
Cleveland Electric Motor Co., Cleveland, Ohio
Electric Machinery Mfg. Co., Minneapolis, Minn.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N.Y.
Holstead & Mitchell, Pittsburgh, Pa.
Harnischfeger Corp., Milwaukee, Wis.
Ideal Electric & Mfg. Co., Mansfield, Ohio
Maid-O-Mist, Inc., Chicago, Ill.
Reliance Electric & Engineering Co., Cleveland, Ohio
Robbins & Myers, Inc., Springfield, Ohio
Star-Kimble Motor Division, Kimble Printing Press & Mfg. Co., Bloomfield, N.J.
Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric Corp., Pittsburgh, Pa.

NEEDLE VALVE ASSEMBLIES

Henry Valve Co., Melrose Park, Ill.
James P. Marsh Corp., Skokie, Ill.
Cyrus Shank Co., Chicago, Ill.
York Corp., York, Pa.

NITROGEN

NOZZLES, SPRAY

Bahnson Co., Winston-Salem, N.C.
Beta Fog Nozzle, Inc., Greenfield, Mass.
Binks Mfg. Co., Chicago, Ill.
Carrier Corp., Syracuse, N.Y.
Grinnell Company, Providence, R.I.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.
Maid-O-Mist Inc., Chicago, Ill.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Parks Cramer Co., Fitchburg, Mass.
Schutte & Koerting Co., Cornwells Heights, Pa.
Spraying Systems Co., Bellwood, Ill.
Wm. Steinen Mfg. Co., Newark, N.J.
Thermal Agency, Houston, Texas
TOT Towers, Inc., Houston, Texas
Water Cooling Corp., New York, N.Y.
Worthington Corp., Harrison, N.J.
York Corp., York, Pa.

OIL BURNING ENGINES (See Engines, Diesel)

OIL COOLERS AND SYSTEMS (See Heat Exchangers)

OIL FILTERS (See Filters, Oil)

OIL PUMPS (See Pumps by Types)

OIL SEPARATORS (See Also Pressure Vessels)

Acme Industries, Inc., Jackson, Mich.
H. A. Phillips & Co., Chicago, Ill.
Schutte & Koerting Co., Cornwells Heights, Pa.
Temprite Products Corp., Birmingham, Mich.
J. E. Watkins Co., Maywood, Ill.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

OIL TANKS (See Pressure Vessels)

OIL TESTING INSTRUMENTS

OILING SYSTEMS (See Lubricators)

OZONE AIR PURIFIERS (See Air Purification Equipment)

PACKING HOUSE MACHINERY

K. G. Brown Mfg. Co. Inc., Mattituck, N.Y.

PACKINGS, MECHANICAL, METALLIC

Crane Packing Co., Chicago, Ill.
Double Seal Ring Co., Fort Worth, Texas.
Durametallic Corp., Kalamazoo, Mich.
Garlock Packing Co., Palmyra, N.Y.
A. C. Horn Div., Sun Chemical Corp., Long Island, N.Y.
Johns-Manville Corp., New York, N.Y.
Mabbs Hydraulic Packing Co., Chicago, Ill.
York Corp., York, Pa.

PAINTS (See Finishes)

PALLETS (See Also Materials Handling)

Acme Pallet Co., Inc., New York, N.Y.
National Pallet Corp., Pittsburgh, Pa.
Pallets, Inc., Hudson Falls, N.Y.
Sterling Lumber & Supply Co., Chicago, Ill.

PANS, DRIP

Dole Refrigerating Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Reliance Electric Machine Co., Cleveland, Ohio
York Corp., York, Pa.

PAPER, BUILDING (See Insulation Accessories)

PEST CONTROL SUPPLIES

Barada & Page, Inc., Kansas City, Mo.
Dow Chemical Co., Midland, Mich.
Water Cooling Corp., New York, N.Y.

PETROLEUM PRODUCTS (See Lubricants)

PILOT LIGHTS (See Protective Devices)

PIPE AND TUBING

Babcock & Wilcox Co., Beaver Falls, Pa.
A. M. Byers Co., Pittsburgh, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
York Corp., York, Pa.

PIPE COILS AND BENDS (See Coils, Bends and Baffle Assemblies)

PIPE COVERINGS (See Insulation)

PIPE FITTINGS (See Fittings, Refrigerant)

PIPE HANGERS

Grinnell Company, Providence, R.I.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

PIPING PLASTIC

Dow Chemical Co., Midland, Mich.

PIPING, REFRIGERANTS

Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

PISTON RINGS

Ballard Sales Co., Fort Worth, Texas
Double Seal Ring Co., Fort Worth, Texas
Garlock Packing Co., Palmyra, N.Y.
Safety Seal Piston Ring Co., Fort Worth, Texas

PLATE COILS (See Coils, Plate)

PLATFORM SCALES (See Scales, Platform)

POWER TRANSMISSION MACHINERY (See Drives)

PREFABRICATED DUCTWORK (See Duct Accessories and Fittings)

PRESSURE REGULATORS (See Regulators, Pressure)

PRESSURE RELIEF DEVICES

J. E. Watkins, Maywood, Ill.

PRESSURE RELIEF VALVES

Aircraft Production Engineers, Chicago, Ill.
A. P. Controls Corp., Milwaukee, Wis.
Atlas Valve Co., Newark, N.J.
Automatic Switch Co., Orange, N.J.
Bell & Gossett Co., Morton Grove, Ill.
Bristol Co., Waterbury, Conn.
A. W. Cash Co., Decatur, Ill.
A. W. Cash Valve Mfg. Corp., Decatur, Ill.
Clark Bros. Co., Olean, N.Y.
Dorsch Gasoline & Vacuum, Inc., Chicago, Ill.
Fisher Governor Co., Marshalltown, Iowa
Frick Co., Waynesboro, Pa.
Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Knoxville, Tenn.
Henry Valve Co., Melrose Park, Ill.
Hoffell Corp., Hinsdale, Ill.
Kieley & Mueller, Inc., Union, N.J.
Kleinhempel Engineering Co., Fullerton, Calif.
Kunkle Valve Co., Inc., Atchison, Kans.
Leslie Co., Lyndhurst, N.J.
Marsh Instrument & Valve Co., Skokie, Ill.
Mercoid Corp., Chicago, Ill.
Penberthy Injector Co., Detroit, Mich.
Refrigerating Specialties Co., Syracuse, N.Y.
Sarco Co., Inc., New York, N.Y.
Schutte & Koerting Co., Cornwells Heights, Pa.
Spence Engineering Co., Walden, N.Y.
Sporlan Valve Co., St. Louis, Mo.
Vilter Mfg. Co., Milwaukee, Wis.
Watts Regulator Co., Lawrence, Mass.
Wheatley Co., Milton, Pa.
Whitlock Mfg. Co., West Hartford, Conn.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

PRESSURE VESSELS

Acme Industries, Inc., Jackson, Mich.
Alloy Welding Co., Inc., Long Island City, N.Y.
Bethlehem Steel Co., Bethlehem, Pa.
Chicago Bridge & Iron Co., Chicago, Ill.
Graver Tank & Mfg. Co., East Chicago, Ind.
Hansen Tank & Boiler Co., Los Angeles, Calif.
Henry Valve Co., Melrose Park, Ill.
Lone Star Steel Co., Dallas, Texas
Pacific Tank & Pipe Co., Los Angeles, Calif.
Patterson-Kelley Co., East Stroudsburg, Pa.
Pressure Vessel Fabricators, Inc., Chicago, Ill.
Struthers-Wells Corp., Warren, Pa.
Superior Tank & Construction Co., Houston, Texas
Temprite Products Corp., Birmingham, Mich.
Vilter Mfg. Co., Milwaukee, Wis.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

PRESSURE VESSELS, FIELD FABRICATED

Chicago Bridge & Iron Co., Chicago, Ill.
Graver Tank & Mfg. Co., East Chicago, Ind.
Hansen Tank & Boiler Co., Los Angeles, Calif.
Lone Star Steel Co., Dallas, Texas
Pacific Tank & Pipe Co., Los Angeles, Calif.
Patterson-Kelley Co., East Stroudsburg, Pa.
Pressure Vessel Fabricators, Inc., Chicago, Ill.
Struthers-Wells Corp., Warren, Pa.
Superior Tank & Construction Co., Houston, Texas
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

PRESSURE VESSELS, LOW SIDE FLOAT

Henry Valve Co., Melrose Park, Ill.
Refrigerating Specialties Co., Syracuse, N.Y.
Sporlan Valve Co., St. Louis, Mo.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

PROTECTIVE DEVICES

Allen-Bradley Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Electric Co., Hartford, Conn.
Automatic Switch Co., Orange, N. J.
Clark Controller Co., Cleveland, Ohio
Electric Controller & Mfg. Co., Cleveland, Ohio
Electric Machinery Mfg. Co., Minneapolis, Minn.
General Controls Co., Glendale, Calif.
General Electric Co., Schenectady, N.Y.
Heinemann Electric Co., Trenton, N.J.
Ideal Electric & Mfg. Co., Mansfield, Ohio
Mercoid Corp., Chicago, Ill.
Reynolds Electric Co., River Grove, Ill.
Westinghouse Electric Corp., Pittsburgh, Pa.
Weston Electrical Instrument Corp., Newark, N.J.

PUMPS, BOOSTER

Allis-Chalmers, Milwaukee, Wis.
Ingersoll-Rand Co., New York, N.Y.
Worthington Corp., Harrison, N. J.

PUMPS, CENTRIFUGAL

Allis-Chalmers, Milwaukee, Wis.
Bell & Gossett Co., Morton Grove, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Ingersoll-Rand Co., New York, N.Y.
Peerless Pump Div., Food Machinery Corp., Los Angeles, Calif.
Worthington Corp., Harrison, N. J.

PUMPS, CONDENSATE RETURN

Bell & Gossett Co., Morton Grove, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Ingersoll-Rand Co., New York, N.Y.
Worthington Corp., Harrison, N. J.

PUMPS, DIAPHRAGM

Milton Roy Pump Co., Philadelphia, Pa.

PUMPS, GEAR

Fairbanks, Morse & Co., Chicago, Ill.
Ingersoll-Rand Co., New York, N.Y.
Worthington Corp., Harrison, N. J.

PUMPS, RECIPROCATING

Fairbanks, Morse & Co., Chicago, Ill.
Ingersoll-Rand Co., New York, N.Y.
Worthington Corp., Harrison, N. J.

PUMPS, ROTARY

Fairbanks, Morse & Co., Chicago, Ill.
Ingersoll-Rand Co., New York, N.Y.
Worthington Corp., Harrison, N. J.

PUMPS, VACUUM

Nash Engineering Co., South Norwalk, Conn.
Welch Scientific Co., Chicago, Ill.

PUMPS, VANE

Fairbanks, Morse & Co., Chicago, Ill.
Ingersoll-Rand Co., New York, N.Y.
Worthington Corp., Harrison, N. J.

PUMPS, VERTICAL

Allis-Chalmers, Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Ingersoll-Rand Co., New York, N.Y.
Worthington Corp., Harrison, N. J.

RECEIVERS, LIQUID

Acme Industries, Inc., Jackson, Mich.
Alloy Welding Co., Inc., Long Island City, N.Y.
Bethlehem Steel Co., Bethlehem, Pa.
Chicago Bridge & Iron Co., Chicago, Ill.
Graver Tank & Mfg. Co., East Chicago, Ind.
Hansen Tank & Boiler Co., Los Angeles, Calif.
Henry Valve Co., Melrose Park, Ill.
Lone Star Steel Co., Dallas, Texas
Pacific Tank & Pipe Co., Los Angeles, Calif.
Patterson-Kelley Co., East Stroudsburg, Pa.
Pressure Vessel Fabricators, Inc., Chicago, Ill.
Struthers-Wells Corp., Warren, Pa.
Superior Tank & Construction Co., Houston, Texas
Temprite Products Corp., Birmingham, Mich.
Vilter Mfg. Co., Milwaukee, Wis.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

RECEIVERS, LIQUID, FIELD FABRICATED

Chicago Bridge & Iron Co., Chicago, Ill.
Graver Tank & Mfg. Co., East Chicago, Ind.
Hansen Tank & Boiler Co., Los Angeles, Calif.
Lone Star Steel Co., Dallas, Texas
Pacific Tank & Pipe Co., Los Angeles, Calif.
Patterson-Kelley Co., East Stroudsburg, Pa.
Pressure Vessel Fabricators, Inc., Chicago, Ill.
Struthers-Wells Corp., Warren, Pa.
Superior Tank & Construction Co., Houston, Texas
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

REFRIGERANTS

Allied Chemical Co., Marinette, Wis.
Armite Laboratories, Los Angeles, Calif.
E. F. Houghton & Co., Philadelphia, Pa.
Linde Air Products Co., New York, N.Y.
Sun Oil Co., Philadelphia, Pa.
Texas Company, New York, N.Y.
Virginia Smelting Co., West Norfolk, Va.
York Corp., York, Pa.

REFRIGERANTS, METHYL CHLORIDE

Ansul Chemical Co., Marinette, Wis.
Armite Laboratories, Los Angeles, Calif.
E. F. Houghton & Co., Philadelphia, Pa.
Linde Air Products Co., New York, N.Y.
Sun Oil Co., Philadelphia, Pa.
Texas Company, New York, N.Y.
Virginia Smelting Co., West Norfolk, Va.
York Corp., York, Pa.

REFRIGERANTS, SULPHUR DIOXIDE

Ansul Chemical Co., Marinette, Wis.
Armite Laboratories, Los Angeles, Calif.
E. F. Houghton & Co., Philadelphia, Pa.
Linde Air Products Co., New York, N.Y.
Sun Oil Co., Philadelphia, Pa.
Texas Company, New York, N.Y.
Virginia Smelting Co., West Norfolk, Va.
York Corp., York, Pa.

REFRIGERATING MACHINES

Carrier Corp., Syracuse, N.Y.
Dole Refrigerating Co., Chicago, Ill.
Frick Co., Waynesboro, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

REGULATORS, PRESSURE

Alco Valve Co., St. Louis, Mo.
Automatic Switch Co., Orange, N.J.
Bell & Gossett Co., Morton Grove, Ill.
Bristol Co., Waterbury, Conn.
A. W. Cash Co., Decatur, Ill.
A. W. Cash Valve Mfg. Corp., Decatur, Ill.
Clark Bros. Co., Olean, N.Y.
Dorsch Gasoline & Vacuum, Inc., Chicago, Ill.
Fisher Governor Co., Marshalltown, Iowa
Frick Co., Waynesboro, Pa.
Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Knoxville, Tenn.
Henry Valve Co., Melrose Park, Ill.
Hoffell Corp., Hinsdale, Ill.
Kieley & Mueller, Inc., Union, N.J.
Kleinhempel Engineering Co., Fullerton, Calif.
Kunkle Valve Co., Inc., Atchison, Kans.
Leslie Co., Lyndhurst, N.J.
Marsh Instrument & Valve Co., Skokie, Ill.
Mercoid Corp., Chicago, Ill.
Penberthy Injector Co., Detroit, Mich.
Refrigerating Specialties Co., Syracuse, N.Y.
Sarco Co., Inc., New York, N.Y.
Schutte & Koerting Co., Cornwells Heights, Pa.
Spence Engineering Co., Walden, N.Y.
Sporlan Valve Co., St. Louis, Mo.
Vilter Mfg. Co., Milwaukee, Wis.
Watts Regulator Co., Lawrence, Mass.
Wheatley Co., Milton, Pa.
Whitlock Mfg. Co., West Hartford, Conn.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

RELAYS

Allen-Bradley Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Electric Co., Hartford, Conn.
Automatic Switch Co., Orange, N. J.
Clark Controller Co., Cleveland, Ohio
Electric Controller & Mfg. Co., Cleveland, Ohio
Electric Machinery Mfg. Co., Minneapolis, Minn.
General Controls Co., Glendale, Calif.
General Electric Co., Schenectady, N.Y.
Heinemann Electric Co., Trenton, N.J.
Ideal Electric & Mfg. Co., Mansfield, Ohio
Mercoid Corp., Chicago, Ill.
Reynolds Electric Co., River Grove, Ill.
Westinghouse Electric Corp., Pittsburgh, Pa.
Weston Electrical Instrument Corp., Newark, N.J.

RELIEF VALVES (See Pressure Relief Valves)

RESILIENT MOUNTINGS

Korfund Co., Inc., Long Island City, N.Y.
Robinson Mfg. Co., Muncy, Pa.

RUBBER GOODS

Mahon Rubber Co., Detroit, Mich.
Robinson Mfg. Co., Muncy, Pa.

SAFETY APPLIANCES

Mine Safety Appliances Co., Pittsburgh, Pa.
Scott Aviation Corp., Lancaster, N.Y.

SAFETY HEADS

Fusible Metals, Inc., Stamford, Conn.
Pressure Relief Valve Engineering Co., Los Angeles, Calif.

SCALES, PLATFORM

Fairbanks, Morse & Co., Chicago, Ill.
Toledo Scale Co., Toledo, Ohio

SEALS, SHAFT

Crane Packing Co., Chicago, Ill.
Durametallic Corp., Kalamazoo, Mich.
Garlock Packing Co., Palmyra, N.Y.
A. C. Horn Div., Sun Chemical Corp., Long Island, N.Y.
Johns-Manville Corp., New York, N.Y.
Mabbs Hydraulic Packing Co., Chicago, Ill.
York Corp., York, Pa.

SHELL AND TUBE HEAT EXCHANGERS (See Heat Exchangers)

SHELVING

Lewis-Shepard Products, Inc., Watertown, Mass.

SIGHT FLOW INDICATORS

Henry Valve Co., Melrose Park, Ill.
Refrigerating Specialties Co., Syracuse, N.Y.
Sporlan Valve Co., St. Louis, Mo.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

SIGHT GLASSES

Henry Valve Co., Melrose Park, Ill.
Refrigerating Specialties Co., Syracuse, N.Y.
Sporlan Valve Co., St. Louis, Mo.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

SILICA GEL

Davison Chemical Co., Baltimore, Md.
Grace Chemical Co., Cambridge, Mass.

SOLENOID VALVES

Alco Valve Co., St. Louis, Mo.
Automatic Switch Co., Orange, N.J.
Bell & Gossett Co., Morton Grove, Ill.
Bristol Co., Waterbury, Conn.
A. W. Cash Co., Decatur, Ill.
A. W. Cash Valve Mfg. Corp., Decatur, Ill.
Clark Bros. Co., Olean, N.Y.
Dorsch Gasoline & Vacuum, Inc., Chicago, Ill.
Fisher Governor Co., Marshalltown, Iowa
Frick Co., Waynesboro, Pa.
Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Knoxville, Tenn.
Henry Valve Co., Melrose Park, Ill.
Hoffell Corp., Hinsdale, Ill.
Kieley & Mueller, Inc., Union, N.J.
Kleinhempel Engineering Co., Fullerton, Calif.
Kunkle Valve Co., Inc., Atchison, Kans.
Leslie Co., Lyndhurst, N.J.
Marsh Instrument & Valve Co., Skokie, Ill.
Mercoid Corp., Chicago, Ill.
Penberthy Injector Co., Detroit, Mich.
Refrigerating Specialties Co., Syracuse, N.Y.
Sarco Co., Inc., New York, N.Y.
Schutte & Koerting Co., Cornwells Heights, Pa.
Spence Engineering Co., Walden, N.Y.
Sporlan Valve Co., St. Louis, Mo.
Vilter Mfg. Co., Milwaukee, Wis.
Watts Regulator Co., Lawrence, Mass.
Wheatley Co., Milton, Pa.
Whitlock Mfg. Co., West Hartford, Conn.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

STARTERS, MOTOR (See Motor Controls and Starters)

STEAM GENERATORS

Bell & Gossett Co., Morton Grove, Ill.
Bryan Steam Corp., Bryan, Ohio
Combustion Engineering Co., New York, N.Y.
Erie City Iron Works, Erie, Pa.
Foster Wheeler Corp., New York, N.Y.
Kewanee Boiler Corp., Kewanee, Ill.
Vilter Mfg. Co., Milwaukee, Wis.

STRAINERS

Bell & Gossett Co., Morton Grove, Ill.
Crane Co., Chicago, Ill.
Henry Valve Co., Melrose Park, Ill.
Refrigerating Specialties Co., Syracuse, N.Y.
Sporlan Valve Co., St. Louis, Mo.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

SUCTION ACCUMULATORS

Henry Valve Co., Melrose Park, Ill.
Refrigerating Specialties Co., Syracuse, N.Y.
Sporlan Valve Co., St. Louis, Mo.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

SUCTION LINE FILTERS

Henry Valve Co., Melrose Park, Ill.
Refrigerating Specialties Co., Syracuse, N.Y.
Sporlan Valve Co., St. Louis, Mo.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

SULPHUR DIOXIDE

Ansul Chemical Co., Marinette, Wis.
Armite Laboratories, Los Angeles, Calif.
E. F. Houghton & Co., Philadelphia, Pa.
Linde Air Products Co., New York, N.Y.
Sun Oil Co., Philadelphia, Pa.
Texas Company, New York, N.Y.
Virginia Smelting Co., West Norfolk, Va.
York Corp., York, Pa.

TANKS (See Pressure Vessels)

TANKS, FIELD FABRICATED (See Pressure Vessels, Field Fabricated)

TANKS, OIL (See Pressure Vessels)

TANKS, WATER

Chicago Bridge & Iron Co., Chicago, Ill.
Graver Tank & Mfg. Co., East Chicago, Ind.
Hansen Tank & Boiler Co., Los Angeles, Calif.
Lone Star Steel Co., Dallas, Texas
Pacific Tank & Pipe Co., Los Angeles, Calif.
Patterson-Kelley Co., East Stroudsburg, Pa.
Pressure Vessel Fabricators, Inc., Chicago, Ill.
Struthers-Wells Corp., Warren, Pa.
Superior Tank & Construction Co., Houston, Texas
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

TANKS, WATER, FIELD FABRICATED

Chicago Bridge & Iron Co., Chicago, Ill.
Graver Tank & Mfg. Co., East Chicago, Ind.
Hansen Tank & Boiler Co., Los Angeles, Calif.
Lone Star Steel Co., Dallas, Texas
Pacific Tank & Pipe Co., Los Angeles, Calif.
Patterson-Kelley Co., East Stroudsburg, Pa.
Pressure Vessel Fabricators, Inc., Chicago, Ill.
Struthers-Wells Corp., Warren, Pa.
Superior Tank & Construction Co., Houston, Texas
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

TEMPERATURE CONTROLS

Allen-Bradley Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Electric Co., Hartford, Conn.
Automatic Switch Co., Orange, N. J.
Clark Controller Co., Cleveland, Ohio
Electric Controller & Mfg. Co., Cleveland, Ohio
Electric Machinery Mfg. Co., Minneapolis, Minn.
General Controls Co., Glendale, Calif.
General Electric Co., Schenectady, N.Y.
Heinemann Electric Co., Trenton, N.J.
Ideal Electric & Mfg. Co., Mansfield, Ohio
Mercoid Corp., Chicago, Ill.
Reynolds Electric Co., River Grove, Ill.
Westinghouse Electric Corp., Pittsburgh, Pa.
Weston Electrical Instrument Corp., Newark, N.J.

TEMPERATURE INDICATORS

Bristol Co., Waterbury, Conn.
Foxboro Co., Foxboro, Mass.
Hastings Instrument Co. Inc., Hampton, Va.
Mason-Neilan Regulator Co., Norwood, Mass.
Merlam Instrument Co., Cleveland, Ohio
Roots Connersville Blower Div., Dresser Industries,
Schutte &Koerting Co., Cornwells Heights, Pa.

TEMPERATURE RECORDERS

Bristol Co., Waterbury, Conn.
Foxboro Co., Foxboro, Mass.
Hastings Instrument Co. Inc., Hampton, Va.
Mason-Neilan Regulator Co., Norwood, Mass.
Merlam Instrument Co., Cleveland, Ohio
Roots Connersville Blower Div., Dresser Industries,
Schutte &Koerting Co., Cornwells Heights, Pa.

TEMPERATURE REGULATORS

Alco Valve Co., St. Louis, Mo.
Automatic Switch Co., Orange, N.J.
Bell & Gossett Co., Morton Grove, Ill.
Bristol Co., Waterbury, Conn.
A. W. Cash Co., Decatur, Ill.
A. W. Cash Valve Mfg. Corp., Decatur, Ill.
Clark Bros. Co., Olean, N.Y.
Dorsch Gasoline & Vacuum, Inc., Chicago, Ill.
Fisher Governor Co., Marshalltown, Iowa
Frick Co., Waynesboro, Pa.
Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Knoxville, Tenn.
Henry Valve Co., Melrose Park, Ill.
Hoffell Corp., Hinsdale, Ill.
Kieley & Mueller, Inc., Union, N.J.
Kleinhempel Engineering Co., Fullerton, Calif.
Kunkle Valve Co., Inc., Atchison, Kans.
Leslie Co., Lyndhurst, N.J.
Marsh Instrument & Valve Co., Skokie, Ill.
Mercoid Corp., Chicago, Ill.
Penberthy Injector Co., Detroit, Mich.
Refrigerating Specialties Co., Syracuse, N.Y.
Sarco Co., Inc., New York, N.Y.
Schutte & Koerting Co., Cornwells Heights, Pa.
Spence Engineering Co., Walden, N.Y.
Sporlan Valve Co., St. Louis, Mo.
Vilter Mfg. Co., Milwaukee, Wis.
Watts Regulator Co., Lawrence, Mass.
Wheatley Co., Milton, Pa.
Whitlock Mfg. Co., West Hartford, Conn.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

THERMOMETERS

Bristol Co., Waterbury, Conn.
Foxboro Co., Foxboro, Mass.
Hastings Instrument Co. Inc., Hampton, Va.
Mason-Neilan Regulator Co., Norwood, Mass.
Merlam Instrument Co., Cleveland, Ohio
Roots Connersville Blower Div., Dresser Industries,
Schutte &Koerting Co., Cornwells Heights, Pa.

THERMOSTATIC EXPANSION VALVES

Alco Valve Co., St. Louis, Mo.
Automatic Switch Co., Orange, N.J.
Bell & Gossett Co., Morton Grove, Ill.
Bristol Co., Waterbury, Conn.
A. W. Cash Co., Decatur, Ill.
A. W. Cash Valve Mfg. Corp., Decatur, Ill.
Clark Bros. Co., Olean, N.Y.
Dorsch Gasoline & Vacuum, Inc., Chicago, Ill.
Fisher Governor Co., Marshalltown, Iowa
Frick Co., Waynesboro, Pa.
Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Knoxville, Tenn.
Henry Valve Co., Melrose Park, Ill.
Hoffell Corp., Hinsdale, Ill.
Kieley & Mueller, Inc., Union, N.J.
Kleinhempel Engineering Co., Fullerton, Calif.
Kunkle Valve Co., Inc., Atchison, Kans.
Leslie Co., Lyndhurst, N.J.
Marsh Instrument & Valve Co., Skokie, Ill.
Mercoid Corp., Chicago, Ill.
Penberthy Injector Co., Detroit, Mich.
Refrigerating Specialties Co., Syracuse, N.Y.
Sarco Co., Inc., New York, N.Y.
Schutte & Koerting Co., Cornwells Heights, Pa.
Spence Engineering Co., Walden, N.Y.
Sporlan Valve Co., St. Louis, Mo.
Vilter Mfg. Co., Milwaukee, Wis.
Watts Regulator Co., Lawrence, Mass.
Wheatley Co., Milton, Pa.
Whitlock Mfg. Co., West Hartford, Conn.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

TOWERS, COOLING

Baltimore Aircoil Co., Baltimore, Md.
Cooling Tower Co., Houston, Texas
Marley Co., Kansas City, Mo.
Ritchie Engineering Co., Los Angeles, Calif.
Temprite Products Corp., Birmingham, Mich.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

TRANSFORMERS

Allen-Bradley Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Electric Co., Hartford, Conn.
Automatic Switch Co., Orange, N. J.
Clark Controller Co., Cleveland, Ohio
Electric Controller & Mfg. Co., Cleveland, Ohio
Electric Machinery Mfg. Co., Minneapolis, Minn.
General Controls Co., Glendale, Calif.
General Electric Co., Schenectady, N.Y.
Heinemann Electric Co., Trenton, N.J.
Ideal Electric & Mfg. Co., Mansfield, Ohio
Mercoid Corp., Chicago, Ill.
Reynolds Electric Co., River Grove, Ill.
Westinghouse Electric Corp., Pittsburgh, Pa.
Weston Electrical Instrument Corp., Newark, N.J.

TRANSMISSION MACHINERY (See Drives)

TRUCKS, FORK LIFT

Allis-Chalmers, Bulk Division, Harvey, Ill.
Economy Engineering Co., Chicago, Ill.
Gifford-Wood Co., Hudson, N.Y.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Johns-Manville Corp., N.J.
Lewis-Shepard Products, Inc., Watertown, Mass.
Link Belt Co., Chicago, Ill.
Moto-Truc Co., Cleveland, Ohio
John H. Nesbitt, Inc., St. Albans, N.Y.
National Pallet Corp., Pittsburgh, Pa.
Ohio Galvanizing & Mfg. Co., Niles, Ohio
Pallets, Inc., New York, N.Y.
Pallets, Inc., Hudson Falls, N. Y.
Wilder Mfg. Co. Inc., Port Jervis, N.Y.

TUBING (See Pipe and Tubing)

VALVES, ANGLE

Alco Valve Co., St. Louis, Mo.
Automatic Switch Co., Orange, N.J.
Bell & Gossett Co., Morton Grove, Ill.
Bristol Co., Waterbury, Conn.
A. W. Cash Co., Decatur, Ill.
A. W. Cash Valve Mfg. Corp., Decatur, Ill.
Clark Bros. Co., Olean, N.Y.
Dorsch Gasoline & Vacuum, Inc., Chicago, Ill.
Fisher Govern

Lunkenheimer Co., Cincinnati, Ohio
Schutte & Koerting, Cornwells Heights, Pa.
Cyrus Stuart Co., Chicago, Ill.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Taco Heaters Inc., Providence, R.I.
Trane Co., LaCrosse, Wisc.
Vilter Mfg. Co., Milwaukee, Wis.
J. E. Watkins Co., Maywood, Ill.
York Corp., York, Pa.

PRESSURE VESSELS

Acme Industries Inc., Jackson, Mich.
Aircraft Production Engineers, Chicago, Ill.
Richard M. Armstrong Co., West Chester, Pa.
Bell & Gossett Co., Morton Grove, Ill.
Belt-Ice Corp., Seattle, Wash.
Buxton Mfg. Co., Dover, N.J.
Carrier Corp., Syracuse, N.Y.
Clark Bros., Olean, N.Y.
Dean Products, Inc., Brooklyn, N.Y.
Detroit, Gasoline & Resort, Inc., Chicago, Ill.
Detroit Ice Machine Co., Detroit, Mich.
Dole Refrigeration Co., Chicago, Ill.
Doyle & Roth Mfg. Co. Inc., Brooklyn, N.Y.
Frick Co., Waynesboro, Pa.
Heat-X-Inc., Brewster, N.Y.
Howe Ice Machine Co., Chicago, Ill.
King Zero Co., Chicago, Ill.
Kohlenberger Engineering Co., Fullerton, Calif.
Kramer Trenton Co., Trenton, N.J.
National Pipe Bending Co., New Haven, Conn.
Niagara Blower Co., New York, N.Y.
Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
H. A. Phillips & Co., Chicago, Ill.
Refrigeration Appliances Inc., Chicago, Ill.
Reliance Refrigerating Machine Co., Chicago, Ill.
Remco Co., Chicago, Ill.
Rex Engineering & Sales Co., Oklahoma City, Okla.
Schutte & Koerting, Cornwells Heights, Pa.
Standard Refrigeration Co., Chicago, Ill.
Temprite Products Corp., Birmingham, Michigan
Vilter Mfg. Co., Milwaukee, Wis.
Henry Vogt Machine Co., Louisville, Ky.
J. E. Watkins Co., Maywood, Ill.
Whitlock Mfg. Co., West Hartford, Conn.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

PRESSURESTATS (See Switches and Controls; see also Controls, Pressure Actuated)

PROTECTIVE COATINGS

Armite Laboratories, Los Angeles, Calif.
Citizen Inc., Pittsburgh, Pa.
Clemp Co., Inc. Chicago, Ill.
Philip Carey Mfg. Co., Cincinnati, Ohio
Chemical Engineering Co., Inc., Dallas, Texas
Chemical Solvent Co., Birmingham, Alabama
Dow Chemical Co., Midland, Mich.
Dubrean Corp., Chemical Div., New York, N. Y.
D. W. Haering & Co., Inc. San Antonio, Texas
Alfred Hague & Co., Inc., Brooklyn, N. Y.
A. C. Horn Div., Sun Chemical Corp., Long Island, N. Y.
E. F. Houghton & Co., Philadelphia, Pa.
Johns-Manville Corp., New York, N. Y.
Kemit Inc., Houston, Texas
Minnie Adhesives Corp., New York, N.Y.
J. W. Mortell Co., Kankakee, Ill.
North American Mogul Products Co., Cleveland, Ohio
Oakite Products, Inc., New York, N. Y.
Pennsylvania Salt Mfg. Co., Philadelphia, Pa.
Sargay Co., Inc., New York, N.Y.
Sotomatic, San Francisco, Calif.
Styrbite Co., Cleveland, Ohio
Sulsay Process Div., Allied Chemical & Dye Corp., New York, N. Y.
Witter & Williams Co., Boston, Mass.
Wyandotte Chemicals Corp., Wyandotte, Michigan

PROTECTIVE DEVICES

Acme Protection Equipment Co., South Haven, Mich.
Allen-Bradley Co., Milwaukee, Wis.
Automatic Switch Co., Orange, N.J.
Bailey Meter Co., Cleveland, Ohio
Ballard Sales Co., Fort Worth, Texas
Bristol Co., Waterbury, Conn.
Brunswick Mfg. Co., St. Louis, Missouri
A. W. Cash Valve Mfg. Co., Decatur, Ill.
General Electric Co., Schenectady, N. Y.
Henry Valve Co., Melrose Park, Ill.
Partlow Corp., New Hartford, N. Y.
Superior Valve & Fittings Co., Pittsburgh, Pa.
York Corp., York, Pa.

PSYCHROMETERS (See Instruments, Indicating & Recording)

PULLEYS (See Drives & Couplings)

PUMP VALVES (See Valves, Parts)

PUMPS (See Types or use listed below)

PUMPS, CENTRIFUGAL

American Marsh Pumps Inc., Battle Creek, Mich.
Bell & Gossett Co., Morton Grove, Ill.
Carver Pump Co., Muscatine, Iowa
Creamery Package Mfg. Co., Chicago, Ill.
Deming Co., Salem, Ohio
Fairbanks, Morse & Co., Chicago, Ill.
Samuel S. Gelber Co., Chicago, Ill.
F. D. Goodfellow Co., Inc., Memphis Tenn.
Gould Pumps, Inc., Seneca Falls, N. Y.
Graymills Corp., Chicago, Ill.
Lancaster Pump & Mfg. Co., Inc. Lancaster, Pa.
Lawrence Pump & Engine Co., Lawrence, Mass.
Chas. S. Lewis Co., Inc., St. Louis, Missouri
New York Air Brake Co., Aurora Pump Div., Aurora, Ill.
Rathman Machinery Co., Cincinnati, Ohio
Taco Heaters Inc., Providence, R. I.
Warren Steam Pump Co., Inc., Warren, Mass.
Worthington Corp., Harrison, N.J.
York Corp., York, Pa.

PUMPS, GEAR, VANE, ETC.

Samuel S. Gelber Co., Chicago, Ill.
Graymills Corp., Chicago, Ill.
New York Air Brake Co., Aurora Pump Div., Aurora, Ill.
Schutte & Koerting, Cornwells Heights, Pa.
Warren Steam Pump Co., Inc., Warren, Mass.
Worthington Corp., Harrison, N. J.

PUMPS, RECIPROCATING

American Marsh Pumps, Inc., Battle Creek, Mich.
Deming Co., Salem, Ohio
Fairbanks, Morse & Co., Chicago, Ill.
Samuel S. Gelber Co., Chicago, Ill.
Gould Pumps, Inc., Seneca Falls, N. Y.
Lancaster Pump & Mfg. Co., Inc. Lancaster, Pa.
Warren Steam Pump Co., Inc., Warren, Mass.
Worthington Corp., Harrison, N.J.
York Corp., York, Pa.

PUMPS, ROTARY

Deming Co., Salem, Ohio
Fairbanks, Morse & Co., Chicago, Ill.
Samuel S. Gelber Co., Chicago, Ill.
Gould Pumps, Inc., Seneca Falls, N. Y.
Graymills Corp., Chicago, Ill.
Nash Engineering Co., South Norwalk, Conn.
Roots-Connersville Blower Div., Dresser Industries Inc., Connersville, Ind.
Schutte & Koerting, Cornwells Heights, Pa.
Warren Steam Pump Co., Inc., Warren, Mass.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

PUMPS, ACCESSORIES AND PARTS

American Marsh Pumps, Inc., Battle Creek, Mich.
Carver Pump Co., Muscatine, Iowa
Lancaster Pump & Mfg. Co., Inc., Lancaster, Pa.
Lawrence Pump & Engine Co., Lawrence, Mass.
Schutte & Koerting, Cornwells Heights, Pa.
Worthington Pump & Machinery Corp., Harrison, N. J.
York Corp., York, Pa.

PUMPS, AIR

Samuel S. Gelber Co., Chicago, Ill.
Nash Engineering Co., South Norwalk, Conn.
Roots Connersville Blower Div., Dresser Industries Inc., Connersville, Ind.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

PUMPS, AMMONIA

American Marsh Pumps Inc., Battle Creek, Michigan
Frick Co. Waynesboro, Pa.
Samuel S. Gelber Co., Chicago, Ill.
Gould Pumps Inc., Seneca Falls, N. Y.
Kohlenberger Engineering Co., Fullerton, Calif.

PUMPS, BRINE

American Marsh Pumps, Inc., Battle Creek, Mich.
Bell & Gossett Co., Morton Grove, Ill.
Carver Pump Co., Muscatine, Iowa
Deming Co., Salem, Ohio
Samuel S. Gelber Co., Chicago, Ill.
Gould Pumps, Inc., Seneca Falls, N. Y.
Graymills Corp., Chicago, Ill.
Kohlenberger Engineering Co., Fullerton, Calif.
Lancaster Pump & Mfg. Co., Inc., Lancaster, Pa.
Lawrence Pump & Engine Co., Lawrence, Mass.
Chas. S. Lewis Co., Inc. St. Louis, Missouri
New York Air Brake Co., Aurora Pump Div., Aurora, Ill.
Robbins & Myers, Inc., Springfield, Ohio
Rathman Machinery Co., Cincinnati, Ohio
Warren Steam Pump Co., Inc., Warren, Mass.
Worthington Corp., Harrison, N.J.
York Corp., York, Pa.

PUMPS, DEEP WELL

Deming Co., Salem, Ohio
Fairbanks, Morse & Co., Chicago, Ill.
Samuel S. Gelber Co., Chicago, Ill.
Gould Pumps, Inc., Seneca Falls, N.Y.
Lancaster Pump & Mfg. Co., Inc. Lancaster, Pa.
New York Air Brake Co., Aurora Pump Div., Aurora, Ill.
Robbins & Myers Inc., Springfield, Ohio
Worthington Corp., Harrison, N. J.

PUMPS, FREON AND METHYL

Hoston Inc., York, Pa.
Kohlenberger Engineering Co., Fullerton, Calif.
New York Air Brake Co., Aurora Pump Div., Aurora, Ill.
Warren Steam Pump Co., Inc. Warren, Mass.
J. E. Watkins Co., Maywood, Illinois
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

PUMPS, VACUUM

Croll-Reynolds Co., New York, N. Y.
Samuel S. Gelber Co., Chicago, Ill.
Gould Pumps, Inc., Seneca Falls, N. Y.
Nash Engineering Co., South Norwalk, Conn.
Robbins & Myers, Inc., Springfield, Ohio
Roots Connersville Blower Div., Dresser Industries, Inc. Connersville, Ind.
Schutte & Koerting Co., Cornwells Heights, Pa.
F. J. Stokes Machine Co., Philadelphia, Pa.
United States Hoffman Corp., New York, N. Y.
Warren Steam Pump Co., Inc., Warren, Mass.
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

PURGERS, REFRIGERANT

Aircraft Production Engineers, Chicago, Ill.
Armstrong Machine Works, Three Rivers, Mich.
Carrier Corp., Syracuse, N. Y.
Frick Co., Waynesboro, Pa.
Howe Ice Machine Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kohlenberger Engineering Co., Fullerton, Calif.
Rex Engineering & Sales Co., Oklahoma City, Okla.
Vilter Mfg. Co., Milwaukee, Wisc.
J. E. Watkins Co., Maywood, Ill.
York Corp, York, Pa.

PURIFIERS, AMMONIA (See Stills, Ammonia)

PURIFIERS, OIL (See also Filters, Oil)

North American Mogul Products Co., Cleveland, Ohio
York Corp., York, Pa.

PURIFIERS, WATER (See Water Treatment)

RECEIVERS (See Pressure Vessels)

RECIRCULATORS, REFRIGERANT

Aircraft Production Engineers, Chicago, Ill.
Alpha Electric Refrigeration Co., Detroit, Mich.
Kohlenberger Engineering Co., Fullerton, Calif.
V. C. Patterson & Associates, Philadelphia, Pa.
Trane Co., LaCrosse, Wisconsin
Vilter Mfg. Co., Milwaukee, Wisc.
J. E. Watkins Co., Maywood, Illinois
Worthington Corp., Harrison, N. J.
York Corp., York, Pa.

RECORDERS, HUMIDITY, PRESSURE TEMPERATURE (See Instruments, Recording)

REDUCERS, SPEED (See Drives & Couplings)

REDUCING GEARS (See Drives & Couplings)

REFRIGERANTS

American Potash & Chemicals Corp., Los Angeles, Calif.
Ansul Chemical Co., Marinette, Wisc.
Barada & Pegg Inc., Kansas City, Mo.
Henry Dewer Chemical Mfg. Co., Philadelphia, Pa.
Carrier Corp., Syracuse, N. Y.
Electrochemicals Div., E. I. Dupont de Nemours & Co., Wilmington, Dela.
General Chemical Div., Allied Chemical & Dye Corp., New York City, N. Y.
Khatic Chemicals Inc., E. I. du Pont de Nemours & Co. Wilmington, Dela.
Nitrogen Division, Allied Chemical & Dye Corp., New York, N. Y.
Pennsylvania Salt Mfg. Co., Philadelphia, Pa.
Spencer Chemical Co., Kansas City, Mo.
Virginia Smelting Co., West Norfolk, Va.
York Corp., York, Pa.

REFRIGERATORS: SECTIONAL, PORTABLE, PREFABRICATED

Ballard Sales Co., Fort Worth, Texas
Bohlen, Inc., Rapid Cut, Mich.
Clean Cold Storage Door Co., Reading, Ohio
Creamery Package Mfg. Co., Chicago, Ill.
Kohlenberger Engineering Co., Fullerton, Calif.
LaCrosse Cooler Co., LaCrosse, Wis.
Nor-Lake Inc., Hudson, Wisc.
Refrigeration Engineering Co., Minneapolis, Minn.

U. S. Thermo Controls Co., Minneapolis, Minn.
Vilter Mfg. Co., Milwaukee, Wisc.
J. E. Watkins Co., Maywood, Ill.
York Corp., York, Pa.

REFRIGERATION SYSTEMS

Advanced Engineering Corp., Milwaukee, Wisc.

REGISTERS (See Grilles)

REGULATING VALVES (See Valves Regulating; See also Regulators, Flow)

REGULATORS, DAMPER (See Damper Motors and Regulators)

REGULATORS, FLOW

A-P Controls Corp., Milwaukee, Wis.
Atlas Valve Co., Newark, N. J.
Bailey Meter Co., Cleveland, Ohio
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
A. W. Cash Valve Mfg., Corp., Decatur, Ill.
Detroit Controls Corp., Detroit, Mich.
Fisher Governor Co., Marshalltown, Iowa
Foxboro Co., Foxboro, Mass.
General Controls Co., Glendale, Calif.
Hubbell Corp., Kankakee, Ill.
Johnson Service Co., Milwaukee, Wisc.
Mason-Neilan Regulator Co., Norwood, Mass.
Refrigerating Specialties Co., Chicago, Ill.
Schutte & Koerting Co., Cornwells Heights, Pa.
Sporlan Valve Co., St. Louis, Mo.
Taco Heaters Inc., Providence, R. I.
Trane Co., LaCrosse, Wis.
York Corp., York, Pa.

REGULATORS, LIQUID, LEVEL (See Controls, Liquid Level)

REGULATORS, PRESSURE

Air Reduction Sales Co., New York, New York
Atlas Valve Co., St. Louis, Mo.
A-P Controls Corp., Milwaukee, Wis.
Atlas Valve Co., Newark, N. J.
Bailey Meter Co., Cleveland, Ohio
Bristol Co., Waterbury, Conn.
Barber-Colman Co., Rockford, Ill.
A. W. Cash Co., Decatur, Ill.
A. W. Cash Valve Mfg., Corp., Decatur, Ill.
Dunham, Bush & Dunham, Inc., Chicago, Ill.
Detroit Controls Corp., Detroit, Mich.
Fisher Governor Co., Marshalltown, Iowa
Flow Products Co., Skokie, Ill.
Fulton Sylphon Div., Robertshaw-Fulton Controls, Knoxville, Tenn.
General Controls Co., Glendale, Calif.
Hubbell Corp., Kankakee, Ill.
Johnson Service Co., Milwaukee, Wisc.
Mason-Neilan Regulator Co., Norwood, Mass.
Marold Corp., Chicago, Ill.
Powers Regulator Co., Skokie, Ill.
Refrigerating Specialties Co., Chicago, Ill.
Reggio-Klingeman Mfg. Co., Salem, Mass.
Schutte & Koerting Co., Cornwells Heights, Pa.
Sporlan Valve Co., St. Louis, Mo.
Taco Heaters Inc., Providence, R. I.
Trane Co., LaCrosse, Wis.
Water Cooling Corp., New York, N. Y.
York Corp., York, Pa.

REGULATORS, TEMPERATURE

A-P Controls Corp., Milwaukee, Wis.
Atlas Valve Co., Newark, N. J.
Bailey Meter Co., Cleveland, Ohio
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Bowles Instrument Co., Clarkson, N. J.
A. W. Cash Co., Decatur, Ill.
Dunham, Bush & Dunham, Chicago, Ill.
Fisher Governor Co., Marshalltown, Iowa
Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Philadelphia, Pa.
Fulton Sylphon Div., Robertshaw-Fulton Controls, Knoxville, Tenn.
General Controls Co., Glendale, Calif.
Hubbell Corp., Kankakee, Ill.
Johnson Service Co., Milwaukee, Wisc.
Leeds and Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Norwood, Mass.
Marold Corp., Chicago, Ill.
Partlow Corp., New Hartford, N. Y.
Refrigerating Specialties Co., Chicago, Ill.
Trane Co., La Crosse, Wisconsin

REGULATORS, VOLTAGE (See Electrical Line Equipment)

RELAYS, ELECTRICAL (See Motor Controls and Starters)

RELIEF VALVES (See Pressure Relief Valves)

RESISTORS, ELECTRICAL (See Motor Controls and Starters)

RETARDERS, CORROSION (See Water Treatment)

RHEOSTATS (See Motor Controls and Starters)

ROOF COOLING

Rapp-right's Rotary Roof Cooler, Los Angeles, Calif.
Tropical Paint Co., Cleveland, Ohio
Tuferate Co., Inc., Des Moines, Iowa
Water Cooling Corp., New York, N. Y.

RUBBER PRODUCTS

Garlock Packing Co. Palmyra N.Y.
Great American Industries, Bedford, Va.
E. F. Houghton & Co., Philadelphia, Pa.
Jarvis Products Inc., Chicago, Ill.
Johns-Manville Corp., New York, N. Y.
Stic-Klip Mfg. Co., Cambridge, Mass.

RUST PREVENTATIVES (See Coatings, also Water Proof Paints)

SAFETY APPLIANCES

Acme Protection Equipment Co., South Haven, Mich.
Ballard Sales Co., Fort Worth, Texas
E. F. Houghton & Co., Philadelphia, Pa.
Ice Plant Equipment Co., Philadelphia, Pa.
York Corp., York, Pa.

SAFETY DEVICES (See Protective Devices)

SAFETY VALVES (See Valves, Safety, also Pressure Relief Valves)

SCALE TRAPS (See also Strainers, Refrigerant)

Aircraft Production Engineers, Chicago, Ill.
Kohlenberger Engineering Co., Fullerton, Calif.
H. A. Phillips & Co., Chicago, Ill.
Reliance Electric Machine Co., Cleveland, Ohio
Henry Vogt Machine Co., Louisville, Kentucky
York Corp., York, Pa.

SCALE TREATMENT (See Water Treating Material)

SCALES, PLATFORM

Fairbanks, Morse & Co., Chicago, Ill.
Flow Products Co., Berwyn, Ill.
John H. Marcott, Inc., St. Albans, N. Y.

SEALING COMPOUNDS

Armite Laboratories, Los Angeles, Calif.
Crane Packing Co., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Johns-Manville Corp., New York, N. Y.
Lake Chemical Co., Chicago, Ill.
North American Rigid Products Co., Cleveland, Ohio
Quigley Co., Inc., New York, N. Y.
Virginia Smelting Co., West Norfolk, Virginia

SEALS SHAFT, MECHANICAL

Carrier Corp., Syracuse, N. Y.
Crane Packing Co., Chicago, Ill.
Durametallic Corp., Kalamazoo, Michigan
Fulton Sylphon Div., Robertshaw-Fulton Controls, Knoxville, Tenn.
Garlock Packing Co., Palmyra, N. Y.
Kohlenberger Engineering Co., Fullerton, Calif.
Keepers Co., Inc., Pittsburgh, Pa.
Sealol Corporation, Providence, R. I.
York Corp., York, Pa.

SEATS, COMPRESSOR VALVE (See Compressor Parts and Accessories)

SEPARATORS, OIL

Acme Industries Inc., Jackson, Mich.
Mast-X-Inc., Brewster, N. Y.
Niem Ice Machine Co., Chicago, Ill.
Vilter Mfg. Co., Milwaukee, Wisc.
York Corp., York, Pa.

SHAFT COUPLINGS (See Drives & Couplings)

SHAFT SEALS (See Seals, Shaft, Mechanical)

SHELLS (See Pressure Vessels)

SIGHT GLASSES (See Liquid Indicators; also Gauge Glasses)

SIGNALS, ELECTRIC (See also Protective Devices)

SILICA GEL (See Dehydrants)

SIZED ICE EQUIPMENT

Ballard Sales Co., Fort Worth, Texas
Bateman Foundry & Machine Co., Inc., Mineral Wells, Texas
Frick Co., Waynesboro, Pa.
Ice Plant Equipment Co., Inc., Philadelphia, Pa.
York Corp., York, Pa.

SODIUM CHLORIDE

Solvay Process Division, Allied Chemical & Dye Corp., New York, N. Y.

SODIUM DICHROMATE (See Water Treating Materials)

SOFTENERS, WATER (See Water Treatment)

SOLDERS, SOLDERING MATERIAL

Eutectic Welding Alloys Co., Flushing, N. Y.
Lake Chemical Co., Chicago, Ill.
Metametals, San Francisco, Calif.

SOLENOID VALVES, REFRIGERANT

Atlas Valve Co., St. Louis, Mo.
A-P Controls Corp., Milwaukee, Wisc.
Automatic Valve Co., Indianapolis, Ind.
Automatic Switch Co., Orange, N. J.
Detroit Controls Corp., Detroit, Mich.
General Controls Co., Glendale, Calif.
Hubbell Corp., Kankakee, Ill.
Johns-Manville Corp., New York, N. Y.
Kold-O-Mist Inc., Chicago, Ill.
James P. Marsh Corp., Skokie, Ill.
Marold Corp., Chicago, Ill.
H. A. Phillips & Co., Chicago, Ill.
Refrigerating Specialties Co., Chicago, Ill.
Reggio-Klingeman Mfg. Co., Salem, Mass.
Schutte & Koerting Co., Cornwells Heights, Pa.
Sporlan Valve Co., St. Louis, Mo.
Trane Co., LaCrosse, Wis.
York Corp., York, Pa.

SOLENOID VALVES, WATER, BRINE, ETC.

Atlas Valve Co., St. Louis, Mo.
A-P Controls Corp., Milwaukee, Wisc.
Automatic Valve Co., Indianapolis, Ind.
Automatic Switch Co., Orange, N. J.
Detroit Controls Corp., Detroit, Mich.
General Controls Co., Glendale, Calif.
Johns-Manville Mfg., Co., St. Louis, Mo.
James P. Marsh Corp., Skokie, Ill.
Marold Corp., Chicago, Ill.
Refrigerating Specialties Co., Chicago, Ill.
Reggio-Klingeman Mfg., Co., Salem, Mass.
Sporlan Valve Co., St. Louis, Mo.
Trane Co., LaCrosse, Wis.
York Corp., York, Pa.

SPEED CHANGERS (See Drives)

SPEED INDICATORS (See Revolution Counters or Tachometers)

SPEED REDUCING GEARS (See Drives)

SPRAY HUMIDIFIERS (See Humidifying Systems)

SPRAY PONDS (See also Cooling Towers)

SPRAY SYSTEMS AND ACCESSORIES

Bahnson Co., Winston-Salem, N. C.
Binks Mfg. Co., Chicago, Ill.
Grinnell Company, Providence, R. I.
Schutte & Koerting Co., Cornwells Heights, Pa.
Water Cooling Corp., New York, N. Y.
York Corp., York, Pa.

SPRAY TYPE EVAPORATORS (See Coils, Blower Units)

STARTERS, ELECTRIC MOTOR (See Motor Controls and Starters)

STEAM JET VACUUM COOLING SYSTEMS (See Ejectors)

STEEL PIPE (See Pipe and Tubing)

STILLS, AMMONIA

Smith Pumps Inc., Sauks Falls, N. Y.
Kohlenberger Engineering Co., Fullerton, Calif.
Vilter Mfg., Co., Milwaukee, Wisc.
York Corp., York, Pa.

STORAGE BATTERIES (See Batteries Storage)

STRAINERS, AIR, OIL, STEAM, WATER

Alco Valve Co., St. Louis, Mo.
A-P Controls Corp., Milwaukee, Wis.
Armstrong Machine Works, Three Rivers, Michigan
Automatic Switch Co., Orange, N. J.
Bell & Gossett Co., Morton Grove, Ill.
A. W. Cash Co. Decatur, Ill.
A. W. Cash Valve Mfg., Corp., Decatur, Ill.
Elliott Co., Jeannette, Pa.
General Controls Co., Glendale, Calif.
Hetbell Corp., Mendota, Ill.
Ice Plant Equipment Co., Inc., Philadelphia, Pa.
Mold-A-Rest Inc., Chicago, Ill.
James P. Marsh Corp., Skokie, Ill.
Mason-Neilan Regulator Co., Norwood, Mass.
Monarch Mfg. Works Inc. Philadelphia, Pa.
Ruppler-Kingston Mfg. Co., Salem, Mass.
Schutte & Koerting Co., Cornwells Heights, Pa.
Trane Co., LaCrosse, Wisc.
York Corp., York, Pa.

STRAINERS, REFRIGERANT

Aircraft Production Engineers, Chicago, Ill.
Alco Valve Co., St. Louis, Mo.
A-P Controls Corp., Milwaukee, Wisc.
Automatic Switch Co., Orange, N. J.
A. W. Cash Co., Decatur, Ill.
A. W. Cash Valve Mfg., Corp. Decatur, Ill.
Dorsch, Gaenslen & Hilbert, Inc., Chicago, Ill.
Henry Valve Co., Melrose Park, Ill.
Hetbell Corp., Mendota, Ill.
Refrigerating Specialties Co., Chicago, Ill.
Sporlan Valve Co., St. Louis, Mo.
Trane Co., LaCrosse, Wisc.
York Corp., York, Pa.

STYROFOAM (See Insulation)

SUCTION PRESSURE REGULATOR (See Valves, Back Pressure)

SULPHUR DIOXIDE, ANHYDROUS (See Refrigerants)

SURGE TANKS (See PRESSURE VESSELS)

SWITCHBOARDS

Electric Machinery Mfg. Co., Minneapolis, Minn.
General Electric Co., Schenectady, N. Y.

SWITCHES AND CONTROLS

Allen-Bradley Co., Milwaukee, Wisc.
Arrow-Hart & Hegeman Electric Co., Hartford, Conn.
Automatic Switch Co., Orange, N. J.
Bristol Co., Waterbury, Conn.
Clark Controller Co., Cleveland, Ohio
Detroit Controls Co., Detroit, Mich.
General Controls Co., Glendale, Calif.
General Electric Co., Schenectady, N. Y.
Hetbell Corp., Mendota, Ill.
Johnson Service Co., Milwaukee, Wisc.
Mercoid Corp., Chicago, Ill.
Penn Electric Co., Two Rivers, Wisc.

SWITCHES, ELECTRIC (See also Controls; Motor Controls and Starters; Time Switches)

Allen-Bradley Co., Milwaukee, Wis.
Automatic Switch Co., Orange, N.J.
Clark Controller Co., Cleveland, Ohio
General Controls Co., Glendale, Calif.
J-B-T Instruments Inc., New Haven, Conn.

TACHOMETERS

Bailey Meter Co., Cleveland, Ohio
Bristol Co., Waterbury, Conn.
Foxboro Co., Foxboro, Mass.
General Electric Co., Schenectady, N.Y.
Reliance Electric & Engineering Co., Cleveland, Ohio
Weston Electrical Instrument Corp., Newark, N.J.

TANKS (See also Pressure Vessels)

Fluidyne Mfg. Co., Brooklyn, N.Y.
Hahnemann Engineering Co., Fullerton, Calif.
Schutte & Koerting, Cornwells Heights, Pa.
Vilter Mfg. Co., Milwaukee, Wisc.
York Corp., York, Pa.

TANKS, BRINE (SEE Brine Tanks)

TANKS LATENT HEAT

Aircraft Production Engineers, Chicago, Ill.
Heat Products Inc., Brooklyn, N.Y.
Refrigerating Co., Chicago, Ill.
McKay Inc., Minneapolis, Minn.
Henry Vogt Machine Co., Louisville, Ky.
York Corp., York, Pa.

TANKS, MILK HOLDING

Creamery Package Mfg. Co., Chicago, Ill.
Ingersoll Iron Co., Chicago, Ill.

TAPE INSULATING AND PRESSURE SENSITIVE (See Insulation Accessories)

TEMPERATURE CONTROLLERS, AUTOMATIC

Allen-Bradley Co., Milwaukee, Wis.
Alco Valve Co., Newark, N.J.
Bailey Meter Co., Cleveland, Ohio
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Fielden Instrument Div., Robertshaw-Fulton Controls Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Fulton Sylphon Div., Robertshaw-Fulton Controls, Knoxville, Tenn.
General Controls Co., Glendale, Calif.
General Electric Co., Schenectady, N.Y.
Hetbell Corp., Mendota, Ill.
Johnson Service Co., Milwaukee, Wis.
Leeds and Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Norwood, Mass.
Mercoid Corp., Chicago, Ill.
Moeller Instrument Co., Inc., Richmond Hill, N.Y.
Partlow Corp., New Hartford, N.Y.
Powers Regulator Co., Skokie, Ill.
Ruppler-Kingston Mfg. Co., Salem, Mass.
Trane Co., LaCrosse, Wis.

TEMPERATURE RECORDING INSTRUMENTS (See Instruments Recording)

TESTING INSTRUMENTS (See Subject Type; Electrical Line Equipment; Also Water Treating Accessories, etc.)

TEST CABINETS, LOW TEMPERATURE (See Low Temperature Test Cabinets)

THERMOMETERS (See Instruments, Recording)

THERMOMETERS, RECORDING (See Instruments, Recording)

THERMOSTATS AND PARTS (See also Controls)

A-P Controls Corp., Milwaukee, Wisc.
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Detroit Controls Corp., Detroit, Mich.
General Controls Co., Glendale, Calif.
General Electric Co., Schenectady, N.Y.
Hetbell Corp., Mendota, Ill.
Johnson Service Co., Milwaukee, Wis.
Mercoid Corp., Chicago, Ill.
John H. Merrell Inc., St. Albans, N.Y.
Partlow Corp., New Hartford, N.Y.
Powers Regulator Co., Skokie, Ill.

THERMOSTATIC EXPANSION VALVES (See Expansion Valves)

TIERING MACHINES (See Materials Handling)

TIME RECORDS (See Instruments, Recording)

TIME SWITCHES (See also Controls, also Switches, Electric)

Allen-Bradley Inc., Manitowoc, Wis.
Allen-Bradley Co., Milwaukee, Wis.
Automatic Temperature Control Co., Philadelphia, Pa.
Clark Controller Co., Cleveland, Ohio
General Controls Co., Glendale, Calif.
Johnson Service Co., Milwaukee, Wis.
Penagal Electric Co., Two Rivers, Wis.

TIMERS

Allen-Bradley Inc., Manitowoc, Wis.
Automatic Temperature Control Co., Philadelphia, Pa.
Bailey Meter Co., Cleveland, Ohio
Bristol Co., Waterbury, Conn.
General Controls Co., Glendale, Calif.
General Electric Co., Schenectady, N.Y.
Johnson Service Co., Milwaukee, Wis.
Weston Electrical Instrument Co., Manitowoc, N.H.
James P. Marsh Corp., Skokie, Ill.
Penagal Electric Co., Two Rivers, Wis.
Partlow Corp., New Hartford, N.Y.

TOWERS, WATER COOLING (See Cooling Towers)

TRACK, SLIDING DOOR (See Door Hardware Accessories and Hardware, Cold Storage)

TRANSFORMERS (See also Electrical Line Equipment)

General Controls Co., Glendale, Calif.
Wagner Electric Corp., St. Louis, Mo.
Weston Electrical Instrument Corp., Newark, N.J.

TRAPS, AIR, OIL, REFRIGERANT, STEAM, WATER

A-P Controls Corp., Milwaukee, Wisc.
Armstrong Machine Works, Three Rivers, Mich.
Fisher Governor Co., Marshalltown, Iowa
Frick Co., Waynesboro, Pa.
Henry Valve Co., Melrose Park, Ill.
Hoffmann Engineering Co., Fullerton, Calif.
James P. Marsh Corp., Skokie, Ill.
Reliance Electric Machine Co., Cleveland, Ohio
Trane Co., LaCrosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
J. E. Watkins Co., Maywood, Ill.
York Corp., York, Pa.

TROLLEYS, OVERHEAD CONVEYOR (See also Conveyors)

Link-Belt Co., Chicago, Ill.

TRUCKS, ELECTRIC (See Fork Lift Trucks)

TUBE CLEANERS

Chemical Solvent Co., Birmingham, Ala.
Elliott Co., Jeannette, Pa.
Ice Plant Equipment Co., Inc., Philadelphia, Pa.
Oakite Products Inc., New York, N.Y.
Schutte & Koerting Co., Cornwells Heights, Pa.
Thomas C. Wilson Inc., Long Island City, N.Y.
York Corp., York, Pa.

TUBE ICE MACHINES (See Ice Making Machines)

TUBES AND TUBING (See also Pipe)

Babcock & Wilcox Co., Beaver Falls, Pa.
Flexible Tubing Corp., Guilford, Conn.
Great American Industries, Bedford, Va.
York Corp., York, Pa.

TUNNEL FREEZERS (See Freezers)

TURBO GENERATORS (See Electric Generating Plants)

UNDERCOATERS (See also Coatings and Compounds; also Finishes)

Bakelon Corp., New York, N.Y.
Alfred Hagen & Co. Inc., Brooklyn, N.Y.
Quigley Co., Inc., New York, N. Y.
Tuboscope Co., Inc., Des Moines, Iowa

UNIT COOLERS (See Coils, Blower Units)

V-BELTS (See also Belts)

Browning Mfg. Co., Maysville, Ky.
Gates Rubber Co., Denver, Colo.
Ice Plant Equipment Co., Inc., Philadelphia, Pa.
Link-Belt Co., Chicago, Ill.
Tex-Rope Corp., Grand Rapids, Mich.
Worthington Corp., Harrison, N.J.

VACUUM REFRIGERATION (See Ejectors)

VALVE DISCS, FLAPPERS, REEDS, WAFERS (See Compressor Parts & Accessories)

VALVES, AIR, STEAM, WATER

Automatic Valve Co., Indianapolis, Ind.
Alco Valve Co., Newark, N.J.
Automatic Switch Co., Orange, N.J.
Automatic Temperature Control Co., Philadelphia, Pa.
Bailey Meter Co., Cleveland, Ohio
Barber-Colman Co., Rockford, Ill.
Clark Controller Co., Cleveland, Ohio
Clark Company, Chicago, Ill.
Fisher Governor Co., Marshalltown, Iowa
Fulton Sylphon Div., Robertshaw-Fulton Controls, Knoxville, Tenn.
Grinnell Company, Providence, R.I.
Johnson Service Co., Milwaukee, Wis.
Lunkenheimer Co., Cincinnati, Ohio
Mold-A-Rest Inc., Chicago, Ill.
James P. Marsh Corp., Skokie, Ill.
Mercoid Corp., Chicago, Ill.
Ruppler-Kingston Mfg. Co., Salem, Mass.
Schutte & Koerting Co., Cornwells Heights, Pa.
Sisco Corp., Providence, R.I.
Tate Jennings Inc., Providence, R.I.
Trane Co., LaCrosse, Wis.
Henry Vogt Machine Co., Louisville, Ky.
York Corp., York, Pa.

VALVES, AMMONIA (See Also Fittings, Ammonia)

Aircraft Production Engineers, Chicago, Ill.
Alco Valve Co., St. Louis, Mo.
Automatic Valve Co., Indianapolis, Ind.
Automatic Switch Co., Orange, N.J.
Dorsch, Gaenslen & Hilbert, Inc., Chicago, Ill.
Fisher Governor Co., Marshalltown, Iowa
Frick Co., Waynesboro, Pa.
Fulton Sylphon Div., Robertshaw-Fulton Controls, Knoxville, Tenn.

General Controls Co., Glendale, Calif.
Grinnell Company, Providence, R.I.
Henry Valve Co., Melrose Park, Ill.
Hubbell Corp., Mendota, Ill.
Kuhlenberger Engineering Co., Fullerton, Calif.
Marcoid Corp., Chicago, Ill.
Cyrus Shank Co., Chicago, Ill.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
Henry Vogt Machine Co., Louisville, Ky.
J. E. Watkins Co., Maywood, Ill.
York Corp., York, Pa.

VALVES, AUTOMATIC CUT-OFF

A-P Controls Corp., Milwaukee, Wis.
Automatic Valve Co., Indianapolis, Ind.
Automatic Switch Co., Orange, N.J.
General Controls Co., Glendale, Calif.
Hubbell Corp., Mendota, Ill.
Schutte & Koerting Co., Cornwells Heights, Pa.
Trane Co., LaCrosse, Wis.
York Corp., York, Pa.

VALVES, AUTOMATIC EXPANSION (See Expansion Valves)

VALVES, BACK PRESSURE (See also Controls)

Alco Valve Co., St. Louis, Mo.
A-P Controls Corp., Milwaukee, Wis.
Atlas Valve Co., Newark, N.J.
Automatic Switch Co., Orange, N.J.
Bailey Meter Co., Cleveland, Ohio
Bristol Co., Waterbury, Conn.
A. W. Cash Co., Decatur, Ill.
A. W. Cash Valve Mfg. Corp., Decatur, Ill.
Clark Bros. Co., Olean, N.Y.
Dersch, Gesswein & Newart, Inc., Chicago, Ill.
Detroit Controls Corp., Detroit, Mich.
Fisher Governor Co., Marshalltown, Iowa
Frick Co., Waynesboro, Pa.
Hubbell Corp., Mendota, Ill.
Refrigerating Specialties Co., Chicago, Ill.
Schaefer Inc., Evansville, Ind.
Schutte & Koerting, Cornwells Heights, Pa.
Temprite Products Corp., Birmingham, Mich.
Trane Co., LaCrosse, Wis.
York Corp., York, Pa.

VALVES, CARBON DIOXIDE

Automatic Valve Co., Indianapolis, Ind.
Automatic Switch Co., Orange, N.J.
Grinnell Company, Providence, R.I.
Lunkenheimer Co., Cincinnati, Ohio
Superior Valve & Fittings Co., Pittsburgh, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
York Corp., York, Pa.

VALVES, COMPRESSOR (See Also Compressor Parts)

Aircraft Production Engineers, Chicago, Ill.
Automatic Switch Co., Orange, N.J.
A. W. Cash Valve Mfg. Corp., Decatur, Ill.
Henry Valve Co., Melrose Park, Ill.
Cyrus Shank Co., Chicago, Ill.
Trane Co., LaCrosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
J. H. H. Voss Co., Inc., New York, N.Y.

VALVES, EXPANSION (See Expansion Valves)

VALVES, FLOAT, REFRIGERANT (See Controls, Float Valve)

Frick Co., Waynesboro, Pa.
Ice Plant Equipment Co., Inc., Philadelphia, Pa.
H. A. Phillips & Co., Chicago, Ill.
Trane Co., LaCrosse, Wis.
Henry Vogt Machine Co., Louisville, Ky.
York Corp., York, Pa.

VALVES, FLOAT, WATER (See Also Regulators, Flow)

Atlas Valve Co., Newark, N.J.
Fisher Governor Co., Marshalltown, Iowa
Fulton Sylphon Div., Robertshaw-Fulton Controls, Knoxville, Tenn.
Ice Plant Equipment Co., Inc., Philadelphia, Pa.
Maid-O-Mist Inc., Chicago, Ill.
James P. Marsh Corp., Skokie, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Tot-Towers Inc., Houston, Texas
Trane Co., LaCrosse, Wis.
Water Cooling Corp., New York, N.Y.
York Corp., York, Pa.

VALVES, MOTOR OPERATED

Bailey Meter Co., Cleveland, Ohio
Barber-Coleman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Fisher Governor Co., Marshalltown, Iowa
Foxboro Co., Foxboro, Mass.
General Controls Co., Glendale, Calif.
Grinnell Company, Providence, R.I.
Hubbell Corp., Mendota, Ill.
Johnson Service Co., Milwaukee, Wis.
Lunkenheimer Co., Cincinnati, Ohio
Mason-Neilan Regulator Co., Norwood, Mass.
Marcoid Corp., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schutte & Koerting Co., Cornwells Heights, Pa.

VALVES, PARTS

Automatic Switch Co., Orange, N.J.

VALVES, PRESSURE RELIEF (See Pressure Relief Valves)

VALVES, PUMP

Atlas Valve Co., Newark, N.J.
Garlock Packing Co., Palmyra, N.Y.
Schutte & Koerting Co., Cornwells Heights, Pa.
York Corp., York, Pa.

VALVES, REGULATING

Aircraft Production Engineers, Chicago, Ill.
A-P Controls Corp., Milwaukee, Wisc.
Atlas Valve Co., Newark, N.J.
Bailey Meter Co., Cleveland, Ohio
Barber-Coleman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
A. W. Cash Co., Decatur, Ill.
A. W. Cash Valve Mfg. Corp., Decatur, Ill.
Dersch, Gesswein & Newart, Inc., Chicago, Ill.
Detroit Controls Corp., Detroit, Mich.
Fisher Governor Co., Marshalltown, Iowa
Fulton Sylphon Div., Robertshaw-Fulton Controls, Knoxville, Tenn.
Hubbell Corp., Mendota, Ill.
Johnson Service Co., Milwaukee, Wis.
James P. Marsh Corp., Skokie, Ill.
Mason-Neilan Regulator Co., Norwood, Mass.
Powers Regulator Co., Skokie, Ill.
Refrigerating Specialties Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schutte & Koerting Co., Cornwells Heights, Pa.
Cyrus Shank Co., Chicago, Ill.
Sporlan Valve Co., St. Louis, Mo.
Trane Co., LaCrosse, Wis.
York Corp., York, Pa.

VALVES, RELIEF (See Pressure Relief Valves)

VALVES, SAFETY (See Pressure Relief Valves)

VALVES, SOLENOID (See Solenoid Valves)

VAPOR SEALS (See Insulation Accessories; See also Adhesives, Compounds, etc.)

VARIABLE SPEED TRANSMISSIONS (See Drives)

VENDING STATIONS, ICE

Ballard Sales Co., Fort Worth, Texas
K. G. Brown Mfg. Co., Inc., Mattituck, N.Y.
Ice Plant Equipment Co. Inc., Philadelphia, Pa.
Perfection Ice Scoring Machine Co., Fort Worth, Texas
Refrigeration Engineering Co., Minneapolis, Minn.
S & S Vending Machine Co., San Jose, Calif.
Taylor Made Ice Vending Mfg. Co., Eupora, Miss.

VESSELS, PRESSURE (See Pressure Vessels)

VIBRATION ABSORBERS (See Absorbers, Vibration)

VOLTMETERS (See also electrical, Line Equipment)

Bristol Co., Waterbury, Conn.
Marion Electrical Instrument Co., Manchester, N.H.
Weston Electrical Instrument Corp., Newark, N.J.

WASHERS, AIR (See Air Washers)

WATER AND BRINE TREATING AND TESTING EQUIPMENT

Anderson Chemical Co., Inc., Mason, Co.
Aqua Electric Scale Control, Inc., Cleveland, Ohio
Aqua-Matic Inc., Rockford, Ill.
Calgon Inc., Pittsburgh, Pa.
Chemical Engineering Co., Inc., Dallas, Texas
Chemical Solvent Co., Birmingham, Ala.
Columbia Southern Chemical Corp., Pittsburgh, Pa.
Hawkins Chemical Co., Los Angeles, Calif.
Ice Plant Equipment Co., Inc., Philadelphia, Pa.
North American Mogul Products Co., Cleveland, Ohio
Water Treatment Engineers, Cleveland, Ohio
York Corp., York, Pa.

WATER COOLERS (See Chillers and Coolers)

WATER FILTERS (See Filters, Oil, Water)

WATER METERS (See Also Meters, Flow)

Bailey Meter Co., Cleveland, Ohio
Worthington Corp., Harrison, N.J.

WATER REGULATING VALVES (See also Regulators, Flow)

A-P Controls Corp., Milwaukee, Wis.
Atlas Valve Co., Newark, N.J.
Automatic Switch Co., Orange, N.J.
Bailey Meter Co., Cleveland, Ohio
A. W. Cash Valve Mfg. Corp., Decatur, Ill.
Fisher Governor Co., Marshalltown, Iowa
Hubbell Corp., Mendota, Ill.
Powers Regulator Co., Skokie, Ill.
Refrigerating Specialties Co., Chicago, Ill.
York Corp., York, Pa.

WATER SOFTENERS AND PURIFIERS

Barada & Page, Inc., Kansas City, Mo.
Calgon Inc., Pittsburgh, Pa.
Chemical Engineering Co., Inc., Dallas, Texas
Fairbanks, Morse & Co., Chicago, Ill.
Filtrine Mfg. Co., Brooklyn, N.Y.
Permutit Co., New York, N.Y.
Water Treatment Engineers, Cleveland, Ohio
Wright Chemical Corp., Chicago, Ill.
York Corp., York, Pa.

WATER TREATING MATERIALS

Anderson Chemical Co., Inc., Mason, Co.
Aqua Electric Scale Control, Inc., Cleveland, Ohio
Armite Laboratories, Los Angeles, Calif.
Barada & Page Inc., Kansas City, Mo.
Beardsley-Cheney Co., Columbus, Ohio
Calgon Inc., Pittsburgh, Pa.
Philip Carey Mfg. Co., Cincinnati, Ohio
Chemical Engineering Co., Inc., Dallas, Texas
Chemical Solvent Co., Birmingham, Ala.
Dow Chemical Co., Midland, Mich.
Galvicon Corp., New York, N.Y.
D. W. Haering & Co., Inc., San Antonio, Texas
Hawkins Chemical Co., Los Angeles, Calif.
Lagco & Bowler, Memphis, Tenn.
Linde Air Products Co., New York, N.Y.
J. W. Mortell Co., Kankakee, Ill.
North American Mogul Products Co., Cleveland, Ohio
Oakite Products Inc., New York, N.Y.
Pacific Lumber Co., San Francisco, Calif.
Pennsylvania Salt Mfg. Co., Philadelphia, Pa.
Permutit Co., New York, N.Y.
Quigley Co. Inc., New York, N.Y.
Rotometals, San Francisco, Calif.
Solvay Process Div., Allied Chem. & Dye Corp., New York.
Tuf-crete Co., Inc., Des Moines, Iowa
Virginia Smelting Co., West Norfolk, Va.
Water Treatment Engineers, Cleveland, Ohio
Wright Chemical Corp., Chicago, Ill.
Wyandotte Chemicals Corp., Wyandotte, Mich.

WATER & BRINE TREATMENT

Barada & Page, Inc., Kansas City, Mo.
Bass Refrigerating Co., Chicago, Ill.
Calgon, Inc., Pittsburgh, Pa.
D. W. Haering & Co., Inc., San Antonio, Texas
Hawkins Chemical Co., Los Angeles, Calif.
Water Treatment Engineers, Cleveland, Ohio
Wright Chemical Corp., Chicago, Ill.

WATERPROOF PAINTS (See also Finishes, also Coatings)

Carbolineum Wood Preserving Co., Milwaukee, Wis.
Philip Carey Mfg. Co., Cincinnati, Ohio
Chemical Solvent Co., Birmingham, Ala.
Galvicon Corp., New York, N.Y.
J. W. Mortell Co., Kankakee, Ill.
Quigley Co. Inc., New York, N.Y.
Sigmund Co., Cleveland, Ohio
Tropical Paint Co., Cleveland, Ohio
Tuf-crete Co., Inc., Des Moines, Iowa
Witter & Williams Co., Brighton, Boston, Mass.
Wyandotte Chemicals Corp., Wyandotte, Mich.

WATERPROOFING MATERIALS (See Coatings, Cements)

WATTMETERS (See Meters, Electric, also Electrical Line Equipment)

WELL EQUIPMENT

Air Reduction Sales Co., New York, N.Y.
Eutectic Welding Alloys Co., Flushing, N.Y.
General Electric Co., Schenectady, N.Y.
Homelite Corp., Milwaukee, Wisc.
Velocity Power Tool Co., Pittsburgh, Pa.
Worthington Corp., Harrison, N.J.

WELL EQUIPMENT

Lagco & Bowler, Memphis, Tenn.

WIRE, WELDING (See Welding)

WOOD PRESERVING

Barada & Page, Inc., Kansas City, Mo.
Carbolineum Wood Preserving Co., Milwaukee, Wis.
Dow Chemical Co., Midland, Mich.
Quigley Co., Inc., New York, N.Y.
Witter & Williams Co., Brighton, Boston, Mass.

WROUGHT IRON PIPE (See Pipe and Tubing)

Manufacturer's Directory

REFER TO PAGE 37 FOR PRODUCT CLASSIFCATION

Acme Industries, Inc., 600 N. Mechanic St., Jackson, Mich.
Chicago, Ill., 230 E. Ohio St.
Houston, Texas, 2706 Richmond Ave.
New York, N.Y., 60 E. 42nd St.
Acme Pellet Company, Inc., 15 Park Row, New York 38, N.Y.
Acme Protection Equipment Co., 1211 Kalamazoo St., South Haven, Mich.
Acra Electric Corp., 9909 Pacific Ave., Franklin Park, Ill.
Advanced Engineering Corp., 1882 W. North Ave., Milwaukee 5, Wis.
Agric Machinery Corp., 122 Wall St., New York 5, N.Y.
Aircraft Production Engineers, 1834 - 42 W. 59th St., Chicago 36, Ill.
Air-Perma-Aire Mfg. Co., Prudence Ave. & Hill, Paterson, N.J.
Air Reduction Sales Co., 60 East 42nd St., New York City 17, N.Y.
Airtemp Div., Chrysler Corp., 1600 Webster St., Dayton 1, Ohio.
Alkhon-Read, Inc., 2866 Weidner St., Manitowoc, Wis.
C. Burton Allbright, C. E., 241 W. 72nd St., New York, N.Y.
Alco Valve Company, 865 Kingsland Ave., St. Louis 5, Mo.
Atlanta, Ga., 231 Healey Bldg.
Boston, Mass., 82 Kimball Road (Dedham)
Chicago, Ill., 4564 North Broadway.
Detroit, Mich., 13721 Kenwood (Oak Park)
Fort Worth, Texas, 3457 Rufus St.
Holywood, Fla., 821 Indian Summer Blvd.
Kansas City, Mo., 7006 Aberdeen.
Los Angeles, Calif., 6280 Chalet Drive (Bell Gardens)
Medina, Ohio, P.O. Box 147.
Minneapolis, Minn., 3120 Raleigh Ave.
New Orleans, La., 2712 Green Acres Lane (Metairie)
New York, N.Y., 55 West 42nd St.
Philadelphia, Pa., Land Title Bldg., Broad and Chestnut Sts.
Portland, Ore., 1318 S.E. 7th Av.
San Francisco, Calif., 25 Stillman St.
Seattle, Wash., 421 Michigan St.
Allen-Bradley Co., 136 W. Greenfield Av., Milwaukee, Wis.
Allen Bradley Co.
Albuquerque, N. M., 114 Morningside Dr., N. E.
Atlanta 9, Ga., 1000 Peachtree St.
Baltimore 2, Md., 124 Light St.
Birmingham, Ala., 3021 Seventh Ave., So.
Boston 34, Mass., 24 Brighton Ave.
Bridgeport 3, Conn., 1115 Main St.
Buffalo 3, N. Y., 41 N. Division St.
Canton 6, Ohio, Box 1266 Sta. C
Charleston, W. Va., 310 Union Building
Charlotte 3, N. C., 307 Lincoln St.
Cincinnati 2, Ohio, 2331 Reading Road
Cleveland 3, Ohio, 4312 Carnegie Ave.
Corpus Christi, Tex., P.O. Box 9004.
East Orange, N. J., 350 Main St.
Erie, Pa., 1048 W. 26th St.
Flint, Mich., 322 Genesee Bank Bldg.
Fort Wayne 5, Ind., 4325 South Harrn St.
Grand Rapids 2, Mich., 314 Straight S. W.
Houston 3, Tex., 2920 Commerce Ave.
Indianapolis 2, Ind., 1491 N. Harding St.
Jacksonville 7, Fla., 1446 June St.
Kalamazoo 99, Mich., 2519 Lake St.
Kansas City 8, Mo., 1819 Central St.
Knoxville 17, Tenn., 1311 C. N. Broadway.
Little Rock, Ark., 400 Stall St.
Los Angeles 23, Calif., 1264 S. Boyle Ave.
Louisville 17, Ky., 2209 S. Floyd St.
Memphis 3, Tenn., 718 M & M Building
Miami 32, Fla., 121 S. E. First St.
Milwaukee 4, Wis., 224 W. Greenfield Ave.
New Orleans 13, La., 1637 Magazine St.
New York 17, N. Y., 158 East 44th St.
Omaha 2, Neb., 1614 Izard St.
Philadelphia, Pa., 235 Fairfield Ave.
Phoenix, Ariz., 1902 East Roosy Ave.
Pittsburgh 14, Pa., 3721 W. Liberty Ave.
Portland 14, Oreg., 1004 S. E. Belmont St.
Richmond 22, Va., 2016 Second Ave.
Rochester 4, N. Y., 241 East Ave.
Rockford, Ill., 1815 Broadway
St. Paul 4, Minn., 1988 University Ave.
St. Louis 6, Mo., 904 W. Grand Blvd.
Salt Lake City 1, Utah, 211 South 2nd. West St.
San Antonio, Tex., 101 East Maple St.
San Diego 1, Calif., 301 W 46th St.
San Francisco 10, Calif., 1801 Cortland Ave.
Seattle 1, Wash., 2660 Western Ave.
Springfield 3, Mass., 172 Chestnut St.
Syracuse 3, N. Y., 820 E. Water St.
Tampa 11, Fla., 3611 South Costdge St.
Tulsa 10, Okla., 1526 E. Fourth St.
York, Pa., 663 W. Market St.

Allied Chemical & Dye Corp., 40 Rector St. New York 6, N.Y.
See General Chemical Div. and Nitrogen Div. for branch offices.
Allis Manufacturing Co., 2153 W. Grand Av., Chicago 22, Ill.
Allis-Chalmers, Buda Div., 154th & Commercial Ave., Harvey, Ill.
Louis Allis Co., 427 E. Stewart St., Milwaukee 7, Wis.
Alpha Electric Refrigeration Co., 1119 E. Seven Mile Rd., Detroit 3, Mich.
Aluminal Corp., 429 E. 53rd St., New York 22, N.Y.
San Francisco 9, Calif., 1615 Polk St.
American Air Filter Co., 215 Central Av., Louisville 8, Ky.
American Bitumuls & Asphalt Co., 200 Bush St., San Francisco 4, Calif.
American Blower Corp., 6111 Thomas Av., Detroit 32, Mich.
American Coils Co., 360 Thomas St., Newark, N.J.
American Hair & Felt Co., Room 232 Merchandise Mart, Chicago 54, Ill.
Los Angeles 63, Calif., 1535 N. Ditmon Av.
New York 16, N.Y., 295 Fifth Av.
American Ice Machinery & Equipment Co., 1522 Orchard St., Philadelphia 24, Pa.
American Machine & Metals, Inc., Salesville, Pa.
American Marsh Pumps, Inc., 46 Capital Ave., N.E., Battle Creek, Mich.
American Plate Freezer Corp., 246 Border St., East Boston 28, Mass.
American Potash & Chemicals Corp., 3100 East 26th St., Los Angeles 23, Calif.
Atlanta, Ga., Hart Engineering & Sales Co., 651 W. 10th St. N.W.
Chicago 44, Ill., 4900 W. Madison St.
Dallas, Texas, Lee J. Freitas Co. Inc., 2516 W. Mockingbird Lane.
Denver 1, Colo., Marshall Co., P.O. Box 2704.
Detroit 18, Mich., 17946 Fielding Ave.
Greensboro, N.C., Hart Engineering & Sales Co., 406 E. Greenway, Ill.
Mobile, Ala., Hart Engineering & Sales Co., 3191 Rabson Rd.
New York 16, N.Y., 99 Park Ave.
Ogo Locka, Fla., Hart Engineering & Sales Co., 3190 N.W. 160 th St., P.O. Box 114.
Portland 12, Ore., 2616 N.E. 24th St.
Rensselaer, N.Y., 45 State Road.
San Francisco 4, Calif., 295 Montgomery St.
Seattle 1, Wash., 2609 Second Ave.
St. Louis 8, Mo., Refrigeration Components, Inc., 34 N. Brentwood Blvd.
Ammerman, Davis & Stack, Inc., 912-923 K of P Bldg., Indianapolis 4, Ind.
Anderson Chemical Co., 1630 Waterville Rd., P.O. Box 1494, Mason, Ga.
Annealtat Corp. of America, 10 E. 39th St., New York 16, N.Y.
Ansul Chemical Company, 1 Stanton St., Marinette, Wis.
Baltimore 1, Md., 1107 Maryland Ave.
Baton Rouge, La., 401 Cloud St.
Billings, Montana, 2310 Belknap Av.
Buffalo 27, N.Y., 902 Kenmore Av.
Chicago 17, Ill., 8933 Stony Island Av.
Cleveland 13, Ohio, 1048 Haven Bldg.
Davenport, Iowa, 725 Union Arcade Bldg.
Detroit, Mich., 13529 Puritan Av.
Fort Worth 11, Texas, 2008 Scruggs Drive.
Grand Rapids, Mich., 199 Monroe, N.W., Room 405.
Houston, Texas, 1110 White St.
Indianapolis 21, Ind., West Coat Municipal Airport.
Kansas City, Mo., 3303 Gilham Rd.
Knoxville 18, Tenn., 4672 Walker Blvd.
Los Angeles 3, Calif., P.O. Box 73625.
Midland, Texas, 106 E. Cedar St.
Milwaukee 2, Wis., 719 W. Van Buren St., Suite 750.
New York, N.Y., 60 E. 42nd St.
Oakland 9, Calif., 5906 Grove St.
Omaha, Nebr., 4853 Military.
Pearl, Pa., 24 State Rd.
Philadelphia 30, Pa., 930 N. 29th St.
San Mateo, Calif., 422 Pastoncter Av.
St. Louis, Mo., 2480 Olive St.
Syracuse, N.Y., 647 S. Warren St.
Tulsa, Okla., 1015 S. Cincinnati.
A-P Controls Corp., 2450 E. 32nd St., Milwaukee, Wis.
Aqua Electric Seals Gasket, Inc., 5806 E. 22nd St., Cleveland 15, Ohio
Aqua-Matic Inc., 2412 Grant Av., Rockford, Ill.
Arnold Laboratories, 1609 Broad St., Los Angeles 1, Calif.
Armour and Company, 1355 W. 31st St., Chicago 9, Ill.
Richard M. Armstrong Co., P.O. Box 188, West Chester, Pa.

Armstrong Cork Co., Liberty & Charlotte Sts., Lancaster, Pa.
Albany 10, N.Y., 268 Spruce St.
Atlanta 8, Ga., 727 W. Peachtree St., N.E.
Baltimore 2, Md., 114 South Street.
Birmingham 3, Ala., 2700 - 4th Avenue, North.
Boston 16, Mass., 131 Clarendon St.
Buffalo 23, N.Y., 1674 Kenmore Ave.
Charlotte 3, N.C., 2932 South Griffith St.
Chicago 34, Ill., 6615 W. Irving Park Rd.
Cincinnati 2, Ohio, 138 E. Court St.
Cleveland 14, Ohio, 2979 Superior Av.
Columbus 8, Ohio, 1284 Schaaf Rd.
Dallas 7, Texas, 1824 N. Industrial Blvd.
Denver 4, Colo., 35 W. 9th Ave.
Detroit 26, Mich., 321 Lafayette Av., West.
Harrisburg, Pa., 1831 North Cameron St.
Hartford 6, Conn., 830 Maple Av.
Henderson, Ky., 3rd and Elm Sts.
Houston 3, Texas, 3111 Leeland Av.
Indianapolis 2, Ind., 1120 Central Av.
Jacksonville 4, Fla., 2351 Dennis St.
Kansas City 8, 500 W. 24th St.
Los Angeles 15, Calif., 1206 Maple Ave.
Louisville 4, Ky., 961 Baxter Ave.
Memphis 3, Tenn., 648 Riverside Drive.
Milwaukee 16, Wis., 4900 North 25th St.
Minneapolis 6, Minn., 4539 Hiawatha Ave.
Nashville 4, Tenn., 949 - 12th Avenue, South.
New Orleans 25, La., 7010 Washington Ave.
New York 16, N.Y., 295 Fifth Avenue.
Philadelphia 2, Pa., 15th & Chestnut Sts.
Pittsburgh 22, Pa., 24th St. & Allegheny River.
Portland 10, Ore., 2350 N.W. 21st Place.
Providence 3, R.I., 111 Westminster St.
Richmond 20, Va., 1615 West Broad St.
Rochester 4, N.Y., 328 Main St., East.
St. Louis 16, Mo., 1919 Hampton Av.
South San Francisco, Calif., 304 Shaw Road.
Seattle 4, Wash., 5035 First Ave., South.
Spokane 12, Wash., North 1318 Maple Street.
Tulsa 3, Okla., 219 East Archer St.
Washington 7, D.C., 2321 Wisconsin Avenue, N.W.
Wilmington, Del., 925 Market St.
Armstrong Machine Works, 816 Maple St., Three Rivers, Mich.
Arrow-Hart & Hegeman Electric Co., Hartford, Conn.
Atlantic Valve Co., 545 Abbott St., Indianapolis 25, Ind.

Atlas Valve Co., South & Jefferson Sts., Newark 5, N.J.
Aurora Pump Div., New York Air Brake Co., 49 Lasalle St., Aurora, Ill.
Aurora, Ill., 629 Lasalle St.
Los Angeles 21, Calif., 2319 E. 8th St.
New York 6, N.Y., 90 West Street.
San Francisco 24, Calif., 85 Industrial Street.
Automatic Switch Co., 391 Lakeside Av., Orange, N.J.
Automatic Temperature Control Co., 5200 Pulaski Av., Philadelphia 44, Pa.
Babcock & Wilcox Co., Tubular Products Div., Beaver Falls, Pa.
Bacharach Industrial Instrument Co., 7301 Penn Av., Pittsburgh 8, Pa.
Bahnson Co., 1001 S. Marshall, Winston-Salem, N.C.
Bailey Meter Company, 1050 Ivanhoe Road, Cleveland 10, Ohio
C. Thomas Baker, C.E., 1070 Spring St., N.W., Atlanta, Ga.
Baldwin-Hill Co., 500 Bremig Ave., Trenton 2, N.J.
Ballard Sales Company, P.O. Box 1121, Fort Worth, Texas
Baltimore Aircoil Company, Inc., 2615 Mathews St., Baltimore 18, Md.
Band-It Co., 4081 & Bobbie, Denver 16, Colo.
Barada & Page, Inc., Gulastic & Michigan Aves., Kansas City 20, Mo.
Corpus Christi, Texas, 1509 N. Tancahua.
Dallas 10, Texas, Third & Beriah Sts.
Fort Worth 1, Texas, 2902 South Main St.
Houston 7, Texas, 2612 Center St.
New Orleans, La., P.O. Box 4117, 8332 Maple.
Odessa, Texas, 125 S. Grandview Ave.
Oklahoma City 1, Okla., 1700 W. Grand Av.
St. Louis 7, Mo., Foot of Destrehan St.
Tulsa 3, Okla., 26 North Guthrie St.
Wichita 4, Kans., 2041 North Mosley Ave.

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Atlanta 9, Ga., 370 Trabert Av., N.W.
Baltimore 18, Md., 2322 N. Charles St.
Birmingham 9, Ala., 2007 Central Ave.
Buffalo 16, N.Y., 1441 Hertel Av.
Chicago 26, Ill., 6610 N. Shorldan Rd.
Cincinnati 2, Ohio, 307 E. 4th St.
Cleveland 3, Ohio, 4501 Prospect Av.
Columbia, S.C., 620 Ott Road.
Detroit 27, Mich., 16135 Schoolcraft Rd.
Grand Rapids 2, Mich., 900 Monroe, N.W.

Hoboken, N.J., 44 Hudson St.
Houston 6, Tex., 1951 Richmond Av.
Indianapolis 2, Ind., 1933 Central Av.
Jacksonville 7, Fla., 806 Bayboro St.
Louisville 4, Ky., 1343 Bardstown, Rd.
Milwaukee 2, Wis., 914 N. Broadway
Morristonville 60, Mass., 435 Newtonville Av.
Omaha 8, Nebr., 1245 South 13th St.
Pasadena 2, Calif., 190 E. Glenarm St.
Philadelphia 40, Pa., 1433 W. Erie Av.
Pittsburgh 34, Pa., 2405 Saw Mill Run Blvd.
Portland 14, Ore., 1210 S.E. 7th Av.
Rock Island, Ill., 3714 14th Ave.
St. Louis 8, Mo., 4398D Olive St.
St. Louis 10, Mo., 1246 Hampton Av.
Seattle 8, Wash., P.O. Box 24, Boeing Field
Springfield, Ill., 522 E. Jefferson St.
Syracuse 4, N.Y., 308 Seymour St.

Barnebey-Cheney Co., Cassady at Eighth, Columbus 19, Ohio

Barrstad Sunlight Paint Co., P.O. Box 1365, Providence 1, R.I.

Barry Controls, Inc., 700 Pleasant St., Watertown, Mass.

C. E. Basterville & Sons, 2202 Central Natl. Bank Bldg., Richmond 19, Va.

Bateman Foundry & Machine Co., Inc., Mineral Wells, Texas

Bell & Gossett Co., 8200 N. Austin Av., Morton Grove, Ill.

Belt-Ice Corp., 3400 - 16th W., Seattle 99, Wash.

Stephen J. Benn, C. E., 401 N. Broad St., Philadelphia 8, Pa.

Beto Fog Nozzle Inc., 309 Wells St., Greenfield, Mass.

H. E. Beyster & Associates, Inc., 700 Griswold Bldg., Detroit, Mich.

Beaver Blankets, 640 S. Hughey St., Orlando, Fla.

Binks Manufacturing Co., 3114 44 W. Carroll Av., Chicago 12, Ill.

Bird & Bird Associates, 4568 Zenith Av. N., Minneapolis, Minn.

Born Refrigerating Co., 80 E. Jackson Blvd., Chicago 4, Ill.

Henry Bower Chemical Mfg. Co., 2815 Gray's Ferry Road, Philadelphia 46, Pa.

George B. Bright Co., 2615 - 12th St., Detroit 16, Mich.

Bristol Co., P.O. Box 1790, Waterbury 20, Conn.

Robert T. Brizzolara, 111 Broadway, New York 6, N.Y.

K. G. Brown Mfg. Co., Inc., Wickham Av., Mattituck, N.Y.

S. W. Brown, 405 Lexington Av., New York 17, N.Y.

Browning Mfg. Co., 1235 Browning Drive., Maysville, Ky.

Brundage Co., 500 N. Park St., Kalamazoo, Mich.

Brunner Mfg. Co., Gilbert at Broad Sts., Utica 1, N.Y.
Chagrin Falls, Ohio, P.O. Box 134.
Chicago 30, Ill., 5306 W. Lawrence Av.
Cincinnati, Ohio, 1879 Churchwood Dr.
Dallas, Texas, 5851 Cedar Springs Ave.
Decatur, Ga., 1500 Superior Ave.
Denver, Colo., 3610 Federal Blvd.
Des Moines, Iowa, 3912 Forest Ave.
Jackson 6, Mich., 3619 Concord Dr.
Kansas City, Mo., 228 West 4th St.
Livonia, Mich., 11428 Loveland Ave.
Los Angeles, Calif., 3520 Council St.
Milton 86, Mass., 1221 Canton Av.
Minneapolis, Minn., 1801 Emerson Av. S.
New York, N.Y., 55 West 42nd St.
Towson, Md., 406 Terrace Way.
Waterville, N.Y., 405 Tower Ave.
Wynnewood, Pa., 427 Holly Lane.

Burling Instrument Co., 13 River Road, Chatham, N.J.

Bushman, Inc., 4358 Coolidge Highway, Royal Oak, Mich.

Bussmann Mfg. Co., University at Jefferson, St. Louis.
Chicago 6, Ill. 9 S. Clinton St.
Los Angeles 13, Calif., 1004 East 4th St.
New York 7, N.Y., 53 Park Pl.

Butcher Boy Refrigerator Door Co., West Diggins St., Harvard, Ill.

Buxton Mfg. Co., Franklin Rd., P.O. Box 94, Dover, N.J.

A. M. Byers Company, 717 Liberty Av., Pittsburgh 22, Pa.
Atlanta 3, Ga., 716 Mortgage Guarantee Bldg.
Boston 16, Mass., 200 Berkeley St. Rm. 2410.
Chicago 3, Ill., 625 Field Bldg., 135 S. LaSalle St.
Houston 2, Texas, 1502 Mellie Esperson Bldg.
New York 20, N.Y., 30 Rockefeller Plaza.
Philadelphia 2, Pa.,1120 Girard Trust Bldg.
Pittsburgh 22, Pa., 1501 Clark Bldg.
St. Louis 5, Mo., 25 S. Bemiston Av.
San Francisco 4, Calif., 1256 Rms Bldg.
Washington 4, D.C., 935 Munsey Bldg.
Montreal 25, Quebec, Canada, 1980 Sherbrooke St. West, Room 230.

Calgon, Inc., 323 Fourth Av., Pittsburgh 22, Pa.

Callender Engineering Co., Jones Bldg. Third & Union, Seattle 1, Wash.

Camp Co. Inc., 6958 S. State St., Chicago, Ill.

Canda Engineering Co., P.O. Box 210 R, Montclair, N.J.

Canvas Fabricators, 560 W. Lake St., Chicago 6, Ill.

Carbolineum Wood Preserving Co., 520 W. Highland Av., Milwaukee 3, Wis.

Carey & Miller, Terminal Tower, Cleveland, Ohio

Philip Carey Mfg. Co., Wayne Ave. at Cooper, Cincinnati 15, Ohio

Carneal, Johnston & Wright, 1000 Atlantic Life Bldg., Richmond 19, Va.

Carney Company, Inc., P.O. Box 28, Mankato, Minn.

Carrier Corp., 300 South Geddes St., Syracuse 1, N.Y.

Carver Pump Company, 1056 Hershey Av., Muscatine, Iowa

A. W. Cash Co., 540 N. 18th St., Decatur, Ill.

A. W. Cash Valve Manufacturing Corp., 666 E. Wickham Av., Decatur, Ill.
Atlanta, Ga., 173 Peters St., S.W.
Baltimore, Md., 2301 N. Charles St.
Boston, Mass., 69 A St., South Boston, Mass.
Buffalo, N.Y., 1072 Colvin Av.
Chicago, Ill., 427 W. Erie St.
Cincinnati, Ohio, 1642 Clayton St.
Cleveland, Ohio, 2012 West 25th St.
Dallas, Texas, 9000 Sovereign Row.
Decatur, Ill., 1902 N. Broadway.
Denver, Colo., 1458 Pennsylvania St.
Des Moines, Iowa, 821 Tenth St., West .Des Moines.
Detroit, Mich., 16613 James Couzens Highway.
Elkhart, Ind., 1727 W. Lusher Av.
Flint, Mich., 213 Mary St.
Grand Rapids, Mich., 200 Louis Ave, N.W.
Hartford, Conn., John Post Rd. W. Simsbury, Conn.
Houston, Texas, 4 Chesnwert St.
Indianapolis, Ind., 6177 College Ave.
Kansas City, Mo., 210 W. Tenth St.
Los Angeles, Calif., 5800 S. Main St.
Memphis, Tenn., 35 S. Cooper St.
Milwaukee, Wis., 647 W. Virginia St.
Minneapolis, Minn., 3940 W. 49th St. S.
New Orleans, La., 931 State St.
New York, N.Y., 103 Park Av.
Oklahoma City, Okla., 1120 N.W. 14th St.
Philadelphia, Pa., 67 Cooper St., Woodbury, N.J.
Pittsburgh, Pa., 561 Braddock Av.
St. Louis, Mo., 4 N. Eighth St.
San Francisco, Calif., 1500 Magnolia St., San Carlos, Calif.
Sarpsota, Fla., 441 Prospect Av.
Tacoma, Wash., 3317 N. 31st St.
Washington, D.C., 218 Shoreham Bldg.

Caterpillar Tractor Co., Peoria 8, Ill.

Century Electric Co., 1806 Pine St., St. Louis 3, Mo.
Atlanta 5, Ga., 3133 Maple Drive, N.E.
Birmingham, Ala., 831 N. 19th St.
Boston 10, Mass., Room 528 Rice Bldg.
Buffalo 2, N.Y., Jackson Bldg.
Charlotte, N.C., 211 Atherton St.
Chicago 39, Ill., 4811 W. Fullerton Av.
Cincinnati 2, Ohio, Room 410 American Bldg.
Cleveland 16, Ohio, 20950 Center Ridge Road.
Dallas 2, Texas, Room 704 Texas Bank Bldg.
Davenport, Iowa, Room 1018 Kahl Bldg.
Denver 2, Colo., 1644 Blake St.
Detroit 2, Mich., Room 630 New Center Bldg.
Grand Rapids 2, Mich., 900 Monroe Ave. N.W.
Hartford, Conn., 119 Ann St.
Houston 2, Texas, Room 752 M & M Bldg.
Indianapolis 4, Ind., Room 903 State Life Bldg.
Jacksonville, Fla., Room 1, David Bldg.
Kansas City 6, Mo., Room 610 Pickwick Bldg.
Los Angeles 21, Calif., Room 307, 1855 Industrial St.
Milwaukee 3, Wis., Suite 1902 Wisconsin Tower Bldg.
Minneapolis 8, Minn., Room 306 Colburn Commercial Bldg.
New Orleans 8, La., 1001 St. Charles Ave.
New York 7, N.Y., 30 Vesey St.
Omaha 2, Nebr., Room 626, City National Bank Bldg.
Philadelphia 2, Pa., Room 912 Blue Cross Bldg.
Phoenix, Ariz., 625 W. Madison Av.
Pittsburgh 22, Pa., Room 518 Bessemer Bldg.
St. Louis 3, Mo., 1831 Chestnut St.
Salt Lake City 14, Utah, 1482 Major St.
San Francisco 5, Calif., 595 Monadnock Bldg.
Seattle 4, Wash., Room 323 Lyon Bldg.
Spokane, Wash., West 310 Pacific St.
Syracuse 2, N.Y., Room 814 Syracuse-Kemper Bldg.
Tulsa 3, Okla., 301 Thompson Bldg.

Chase Brass & Copper Co., 236 Grand St., Waterbury 20, Conn.

Chase Cold Storage Door Co., Reading, Ohio

Chase Industrial Refrigeration Equipment Co., 650 Reading Rd., Reading, Ohio

Chemical Engineering Co. Inc., 2030 Logan St., Dallas 1, Texas

Chemical Solvent Company, 3085 - 16th St. North, Birmingham, Ala.

Chemtex, Inc., 74 Bod Court, Elizabeth 3,N.J.

Rosito E. Chirno, C.E., 511 Alexander St., Rochester, N.Y.

Chicago Blower Corporation, 9857 Pacific Av., Franklin Park, Ill.

Chicago Metallic Mfg. Co., 1997 Clybourn Av., Chicago 14, Ill.

Clarage Fan Company, 619 Porter St., Kalamazoo 16, Mich.

Clark Bros. Co., North S Street, Olean, N.Y.
Amarillo, Texas, 1814 Pecos.
Atlanta 8, Ga., 625 W. Peachtree St., N.E.
Chicago 3, Ill., 122 S. Michigan Av.
Houston 13, Texas, P.O. Box 4569.
Los Angeles 58, Calif., 5120 Pacific Blvd.
New York 17, N.Y., 122 E. 42nd St.
Philadelphia 3, Pa., 1413 Market St.
Pittsburgh 22, Pa., Two Gateway Center
San Francisco 4, Calif., 519 California St.
Shreveport, La., 402 Bank Bldg.
Tulsa 16, Okla., P.O. Box 5367.
Washington 5, D.C., 725 - 15th St., N.W.

Clark Controller Co., 1146 E. 152nd St., Cleveland 10, Ohio

Clark Door Co., Inc., 518 Hunterdon St., Newark 6, N.J.

Clausing Brands Co., 326 E. Keefe Ave., Milwaukee 12, Wis.

Cleveland Electric Motor Company, 3213 Chester Av., Cleveland 3, Ohio

Cooling Laboratories, Inc., 325 South Quincy, Tiffin, Ohio

Coldmobile Div., Union Asbestos & Rubber Co., 2900 W. Vermont St., Rock Island, Ill.

Col-Flake Corporation, 2446 S. Ashland Av., Chicago 8, Ill.

Columbia Electric Mfg. Co., 4519 Hamilton Av., Cleveland 14, Ohio

Columbia Southern Chemical Corp., 1 Gateway Center, Pittsburgh 22, Pa.

Commercial Filters Corp., 2 Main St., Malden 76, Mass.
Chicago, Ill., 6409 West North Ave.
Lebanon, Ind.
Ridgefield, N.J., 643 Grand Avenue.

Conner Engineering Corp., 3000 Stelter Rock Lane, Danbury, Conn.
Chicago 6, Ill., 400 West Jackson Blvd.
Los Angeles 42, Calif., 6311 North Figueroa St.
New York 36, N.Y., 500 Fifth Av.

Consolidated Services, Inc., 71 Columbia St., Seattle 4, Wash.

Control Laboratories, 214 W. 29th St., New York 1, N.Y.

Continental Motors Corp., 205 Market St., Muskegon, Mich.

Cramp Company, 836 S. Michigan Av., Chicago 5, Ill.

Cramp Packing Company, 1800 Cuyler Av., Chicago 13, Ill.

Creamery Package Mfg. Co., 1243 W. Washington Blvd., Chicago 7, Ill.
Atlanta 5, Ga., 471 Glen Iris Drive, N.E.
Boston 14, Mass., 138 Washington St.
Buffalo 3, N.Y., 25 Elliott St.
Dallas 35, Texas, 6304 Sovereign Row.
Denver 2, Colo., 1801 Lawrence St.
Houston 2, Texas, 1116 Naple St.
Kansas City 1, Mo., 1408 W. 12th St.
Los Angeles 23, Calif., 2905 E. 11th St.
Minneapolis 1, Minn., 215 Second St., N.
Nashville 10, Tenn., 90 Franklin St.
New York 36, N.Y., 500 Fifth Ave.
Omaha 8, Nebr., 113 S. Tenth St.
Philadelphia 32, Pa., 2715 N. Broad St.
Portland 9, Ore., 35 N.W. Front Ave.
St. Louis 6, Mo., 4720 Delmar Blvd.
Salt Lake City 1, Utah, 202 W. Broadway.
San Francisco 3, Calif., 1251 Howard St.
Seattle 4, Wash., 1600 First Ave., S.
Toledo 4, Ohio, 500 Broadway.
Waterloo, Iowa, 406 Sycamore St.
Toronto 28, Ontario, 267 King St., W.

Croll-Reynolds Co., 17 John Street, New York 38, N.Y.

Philip L. Geddes, C.E., 1420 Walnut St., Philadelphia 2, Pa.

Dean Products, Inc., 1062 Dean St., Brooklyn 38, N.Y.

Baltimore 27, Md., George B. Wilson, Lawyers Hill Rd., Box 27.

Berkeley, Calif., Mario G. Nagano, P.O. Box 72.

Cincinnati 18, Ohio, Ted Schumacher Sales Co., 9 Briarwood Lane.

Glenside, Penna., Pearce, Inc., 25 S. Easton Rd.

Houston 12, Texas, Transco Company, 1107 - 77th St.

Minneapolis 2, Minn., George R. Mathews Co., 620 Plymouth Bldg.

New Haven 15, Conn., Seward Pakker Co., Box 2908 Westville Station.

Orlando, Fla., Stephen J. Benn, 3224 N. Orange Av.

Philadelphia 19, Pa., Charles Lojan, 321 Glen Echo Rd.

Portland 66, Ore., A. K. Johnston, Box 6655.

Shallowater, Texas, C. W. Stewart & Assoc. Box 13.

St. Louis 34, Mo., Roger P. Kipp Co., 620 N. McKnight Rd.

Deming Company, Salem, Ohio

Jay E. Dettmer, Hollow Tree Ridge Road, Darien, Conn.

Detrick, Geyerete & Hazard, Inc., 4099 W. Grand Av., Chicago 39, Ill.

Domestic Products, Inc., 1107 W. Broad St., Falls Church, Va.

Detroit Controls Corp., 5900 Trumbull Av., Detroit 8, Mich.
Cleveland 14, Ohio, 1749 Chester Av.
Los Angeles 14, Calif., 702 S. Hill St.
New York 18, N.Y., 50 W. 40th St.

Dial Port, Ill., 7122 W. Roosevelt Rd.

Detroit Diesel Eng. Div., of General Motors Corp., 13400 W. Outer Drive, Detroit 28, Mich.

Detroit Ice Machine Company, 2615 Trumbull St., Detroit 16, Mich.

M. L. Driver, C.E., P.O., 1836, San Antonio 6, Texas

Bruce Dudeon and Company, 20th & Wyandotte St., Kansas City 41, Mo.

Dole Refrigerating Company, 5980 N. Pulaski Rd., Chicago 31, Ill.

Double Seal Ring Co., 3068 Montgomery St., Fort Worth, Texas
Los Angeles, Calif., 4261 Wilmington Ave.
New Rochelle, N.Y., 25 Homestead Place.

Dover Manufacturing Co., 5117 Weatherford Av., Indianapolis, Ind.
Dow Chemical Co., Midland, Mich.
Atlanta 3, Ga., 55 Marietta, N.W.
Boston 16, Mass., 20 Providence St.
Buffalo 2, N.Y., 70 Niagara St.
Camden 2, N.J., 400 Market St.
Chicago 3, Ill., 135 S. LaSalle St.
Cincinnati 6, Ohio, 2530 Victory Parkway.
Cleveland 13, Ohio, Terminal Tower.
Detroit 2, Mich., Fisher Bldg.
Houston 2, Texas, 2217 Commerce Bldg.
Los Angeles 17, Calif., 900 Wilshire Blvd.
Minneapolis 3, Minn., 1730 Hennepin Ave.
New Orleans 12, La., 308 Maritime Bldg.
New York 20, N.Y., 45 Rockefeller Plaza.
St. Louis 3, Mo., 10 S. Brentwood Blvd.
San Francisco 4, Calif., 300 Sansome St.
Seattle 1, Wash., 1809 Seventh Av.
Washington 3, D.C., 916 Shoreham Bldg.
Doyle & Roth Mfg. Co., Inc., 136-50 Twenty-fourth St., Brooklyn 32, N.Y.
Draper-Maynes, Inc., 3301 Medford St., Los Angeles 63, Calif.
Dynamic Corporation, 606 N. Fairfax St., Alexandria, Va.
Atlanta, Ga., F. J. Evans Engineering Co., 7 N. Rhodes Center, N.W.
Aurora, Ill., N. L. Pearson Co., 23 Island Ave.
Baltimore 14, Md., F. P. Shelton Co., 7819 Elmhurst Av.
Bellevue, Seattle, Wash., Monitor, Inc., P.O. Box 466.
Birmingham 1, Ala., F. J. Evans Engineering Co., P.O. Box 1569.
Columbia, S.C., F. J. Evans Engineering Co., 1499 Blanding St.
Grand Rapids, Mich., Charles E. Allen, 1940 Woodlawn Ave., S.E.
Houston 2, Texas, F. J. Evans Engineering Co., 2105 Crawford St.
Indianapolis, Ind., S. E. Featherstone Company, 937 Architects & Builders Bldg.
Jackson, Miss., F. J. Evans Engineering Co., 846 North State St.
Jamaica, N.Y., Ashcon-Supply Co., 179-15 Jamaica Av.
Los Angeles, Calif., Clifford d'A Hosmer, 2428 North Lovell St.
Lynnfield Center, Mass., James O. Carter, 640 Chestnut St.
Mesa, Ariz., Ben Parsons, 265 Seventh St.
Milwaukee, Wis., R. C. Schuster Co., 1730 N. 124th St.
New York 17, N.Y., Philips Export Company, 100 E. 42nd St.
Philadelphia 22, Pa., John F. Steelen, Inc., 1901 N. Front St.
Pittsburgh 34, Pa., Donald M. Campbell, 4616 Clairton Blvd.
Richmond 20, Va., Catlett-Johnson Corp., 1309 West Main St.
Rochester 10, N.Y., Hilton J. French, P.O. Box 23, Brighton Sta.
St. Louis 3, Mo., Hester-Bradley Co., 1835 Washington Blvd.
St. Paul 4, Minn., C. L. Benson, 1961 St. Anthony Ave.
San Francisco 9, Calif., A. B. Murphy Co., 228 Ninth St.
Toledo 12, Ohio, Alvin R. Cleve, P.O. Box 192.
Youngstown, Ohio, The G. R. Tolerton Co., 17 McGuffy Rd.
Dwinnell Bush Inc. 179 South St., West Hartford, Conn.
E. I. du Pont de Nemours & Co. Wilmington, Del. See Electrochemicals Dept. and Kinetic Div., for branch offices
Duramettic Corp., Factory St., Kalamazoo, Mich.
Economy Engineering Co., 4811 W. Lake St., Chicago, Ill.
Electric Auto-Lite Co., Instrument & Gauge Div., 1201 Champlain St., Toledo 1, Ohio
Chicago, Ill. 600 S. Michigan Av.
New York City, N.Y., Chrysler Bldg.
Electric Controller & Mfg. Co., 4527 Lee Road, Cleveland 28, Ohio.
Electric Machinery Manufacturing Co., 900 Central Av., Minneapolis 13, Minn.
Atlanta, Ga., 522 N. McDonough St.
Baltimore 18, Md., 333 East 29th St.
Beaumont, Texas, 2014 Park St.
Birmingham 4, Ala., 700 Eighth Terrace West.
Bluefield, W. Va., P.O. Box 93.
Boston 16, Mass., Park Square Bldg.
Buffalo 25, N.Y., 5493 Horton Road.
Butte, Mont., 829 Maryland Av.
Charlotte 2, N.C., 1164½ East Fourth St.
Chicago 6, Ill., 20 N. Wacker Drive.
Cincinnati 6, Ohio, 2984 Woodburn Av.
Cleveland 14, Ohio, 215 Euclid Av.
Corpus Christi, Texas, 645 North Port Ave.
Dallas 2, Texas, 1514 Wood St.
Denver 2, Colo., 1644 State St.
Detroit 21, Mich., 9317 W. McNichols Road.
Duluth 4, Minn., 6 South 54th Av. East
El Paso, Texas, 701 North Kansas St.
Grand Rapids 2, Mich., Murray Bldg.
Houston 1, Texas, P.O. Box 1724.
Indianapolis 4, Ind., Roosevelt Bldg.
Kansas City 6, Mo., Dickey Bldg.
Knoxville, Tenn., P.O. Box 395.
Los Angeles 58, Calif., P.O. Box 58213.
Milwaukee 4, Wis., 700 South Fifth St.
Minneapolis 13, Minn., 800 Central Ave.
New Orleans 13, La., 1719 Tchoupitoulas St.
New York 17, N.Y., 110 E. 42nd St.
Omaha 2, Nebr., W.O.W. Building.
Philadelphia 3, Pa., 1617 Pennsylvania Blvd.
Phoenix 19, Ariz., P.O. Drawer 869.
Pittsburgh 22, Pa., 355 — 8th Av.
Portland 9, Ore. 1239 N.W. 12th Av.
Reading, Pa., Stonerstville, Berks Co.
Richmond 1, Va., P.O. Box 131.
St. Louis 6, Mo., 4970 Lindell Blvd.
Salt Lake City 4, Utah, 500 W. 7th South St.
San Francisco 11, Calif., 420 Market St.
Seattle 1, Wash., 2663 Western Av.
Spokane 3, Wash., East 706 Sprague Av.
Syracuse 2, N.Y., 321 Erie Blvd. West.
Tampa 1, Fla., P.O. Box 448.
Tulsa 3, Okla., P.O. Box 727
Washington 6, D.C., 1627 K Street, N.W.
Electric Storage Battery Co., 42 S. 15th St. Philadelphia, Pa.
See Exide Industrial Div. for branch offices.
Electrothermonix Dept. E. I. duPont deNemours & Co., Wilmington, 98, Del.
Baltimore 2, Md., 321 Fallsway.
Boston 16, Mass., 140 Federal St.
Charlotte 1, N.C., 427 W. Fourth St.
Chicago 30, Ill., 7250 N. Cicero Av., Lincolnwood.
Cincinnati 2, Ohio, 2612 Carew Tower.
Cleveland 14, Ohio, 1226 Natl. City Bank Bldg.
Corpus Christi, Texas., 1509 N. Tancahua St.
Dallas, 16, Texas, Third & Berlin Sts.
Detroit 35, Mich., 13698 W. Seven Mile Rd.
Fort Worth 1, Texas., 2902 S. Main St.
Houston 7, Texas, 2212 Center St.
Kansas City 26, Mo., Gabriola and Michigan Aves.
Los Angeles, Calif., P.O. Box 70, El Monte, Calif.
New Orleans 18, La., Magic & Leake Aves.
New York 1, N.Y., 350 Fifth Av.
Odessa, Texas, 123 S. Grandview Ave.
Oklahoma City 1, Okla., 1700 W. Grand Av.
Philadelphia, Pa., 308 E. Lancaster Av., Wynnewood.
San Francisco 4, Calif., 111 Sutter St.
Tulsa 3, Okla., 26 N. Gathrie St.
Wichita 4, Kansas, 2041 N. Mosley Ave.
Elliott Company, Ross Sta., 148 Sesame Av., Newark, N.J.
Elliott Company, Jeannette, Pa.
Engineering Associates, 74 New Montgomery St., San Francisco, Calif.
A. Epstein & Sons, Inc., 2811 W. Fleming Rd., Chicago, Ill.
Estastic Washing Allegn Corp., Flushing, N.Y.
Exide Industrial Division, Electric Storage Battery Co. 42 S. 15th St., Philadelphia 2, Pa.
Atlanta 13, Ga., 1346 Allens Ave. S.W.
Birmingham 9, Ala., 1925-59th Av. S.
Boston 24, Mass., 100 Ashford St.
Buffalo 7, N.Y., 1007 Elmwood Ave.
Chicago 9, Ill., 3330 S. Warren Blvd
Charleston, S.C., P.O. Box 1542.
Charlotte, N.C., 106 N. Caldwell St.
Cincinnati, Ohio, Emery 426, 307 E. 4th St.
Cleveland 14, Ohio, 1014 Engineers Bldg.
Dallas 1, Texas, 2139 McKinney Ave.
Denver 2, Colo., 224 Commonwealth Bldg.
Detroit 4, Mich., 6031 W. Chicago Blvd.
Houston 4, Texas, 4101 San Jacinto St.
Indianapolis 4, Ind., 323 Denham Trust Bldg.
Jacksonville, Fla., 710 Pearl St.
Kansas City 23, Mo., 139 Belmont Blvd.
Kingston, Pa., 93 Parker St.
Los Angeles 15, Calif., 1043 S. Grand Av.
Memphis, Tenn., 602 Sterick Bldg.
Milwaukee 2, Wis., 312 E. Wisconsin Av.
Minneapolis 3, Minn., 1700 Hennepin Av.
New Haven 10, Conn. 266 Church St.
New Orleans 12, La., 406 Civic Center Bldg.
New York 36, N.Y., 23 West 43rd St.
Omaha 2, Nebr., 330 WOW Bldg.
Peoria, Ill., 403 1st Natl. Bank Bldg.
Philadelphia 4, Pa. 101 N. 33rd St.
Phoenix, Ariz., Room 200, 210 W. Adams St.
Pittsburgh 16, Pa., 1400 Potomac Av.
Portland 5, Ore., 1324 S.W. Harrison St.
Rochester 7, N.Y. 74 Park Ave.
St. Louis 8, Mo., 3708 Lindell Blvd.
Salt Lake City 7, Utah, P.O. Box 133, Murray Branch.
San Francisco 24, Calif., 6150 Third St.
Seattle 4, Wash., 1019 Smith Tower Bldg.
Springfield, Mass., 202 Washington St.
Syracuse, N.Y., 210 Harrison St.
Washington 6, D.C., 1819 L St., N.W.
Fairbanks, Morse & Co., 600 S. Michigan Av., Chicago.
Ferris & Hamlin, C.L., 1706 Olive St., St. Louis.
Fielden Instrument Div., Robertshaw-Fulton Controls Co. 2500 N. Fourth St. Philadelphia, Pa.
Filtrine Mfg. Co., 35 Lexington Av. Brooklyn 5, N.Y.
Maurice E. Finn Associates, 50 W. Jackson Blvd., Chicago 4, Ill.
Fire Products Co., 4840 Galva Av., Berwyn, Ill.
Wm. J. Fitzpatrick Co., 240 Isabel St., Los Angeles 65, Calif.
Fisher Governor Company, Marshalltown, Iowa.
Fishkill Corporation, 300 Fowler St., Newburgh 1, N.Y.
Flexible Tubing Corp., New Whitfield St., Guilford, Conn.
Flexonics Corporation, 1400 S. Third Av., Maywood, Ill.
Flynn and Emrich Co., 301 Holliday St., Baltimore 2, Md.
Food Machinery and Chemical Corp., Peerless Pump Div., 301 West Av., Los Angeles 31, Calif.
Hoopeston, Ill. 109 E. Maple St.
San Jose, Calif. 1105 W. Julian St.
Fredrick & Hilmer, 1783 Union Trust Bldg., Cincinnati 2, Ohio.
Fuchs Gas Company, Foxboro, Mass.
Thayer Fuchs, South St., Foxboro, Mass.
Fuquay Equipment Sales, Inc., 1403 N. Duke St., York, Pa.
Frick Company, W. Main St., Waynesboro, Pa.
Atlanta 3, Ga., 1089-A Mortgage Guarantee Bldg., Mail Add., 410 Commonwealth Av.
Charlotte 2, N.C., 1813 Independence Bldg.
Cincinnati 2, Ohio, 3705 Carew Tower.
Dallas 1, Texas, 805 Tower Petroleum Bldg.
Kansas City 6, Mo., 611 Merchandise Mart Bldg.
Los Angeles 14, Calif., Room 782, 626 South Los Angeles St.
Memphis 3, Tenn., 1012 Sterick Bldg.
New Orleans 25, La., 235 Humble Bldg.
New York City 17, N.Y., 370 Lexington Av.
Oklahoma City 8, Okla., 220 Northeast 36th St.
Palatka, Fla., 115 Abstract Bldg.
Philadelphia 7, Pa., 614 Widdenpaan Bldg.
Pittsburgh 22, Pa., 987 Empire Bldg.
St. Louis 2, Mo., 320 North Fourth St.
Washington 5, D.C., 1226 Shoreham Bldg.
Fulton Sylphon Div., Robertshaw-Fulton Controls Co., P.O. Box 400, Knoxville 1, Tenn.
Baltimore 18, Md., 3411 Old York Road.
Boston, Mass., 256 Main St.
Camden, N.J., 22 Haddon Av.
Cincinnati, Ohio, 2710 Woodburn Av.
Detroit, Mich., 8404 W. McNichols Rd.
Los Angeles, Calif., 5101 Imperial Highway.
Washington, D.C., 1625 Eye St., N.W.
Gabbioneta Corp., Chemical Div., 48 W. 29th St., New York 1, N.Y.
Gay B. Gaertner & Associates, 685 Commercial Place, New Orleans 12, La.
Garlock Packing Company, Palmyra, N.Y.
Gates Rubber Co., 999 S. Broadway, Denver, Colo.
Gay Engineering Corp., 3860 Eleventh St., Los Angeles 27, Calif.
James Gayner, 870 Market St., San Francisco, Calif.
S. Gelber & Sons, Inc., 5806 N. Lincoln Av., Chicago 45, Ill.
General Chemical Div. Allied Chemical & Dye Corp. 40 Rector St., New York 6, N.Y.
Albany 5, N.Y., Railroad Ave.
Atlanta 3, Ga., 133 Carnegie Way, N.W.
Baltimore 26, Md., 2000 Race St.
Birmingham 4, Ala., 642 Third Ave. North.
Boston Mass., Medford 55, Mass.
Bridgeport 5, Conn., 924 Wordin Av.
Buffalo 2, N.Y. 1 West Genesee St.
Charlotte 1, N.C., 810 Tuckaseege Rd.
Chicago 32, Ill., 3357 W. 47th Pl.
Cleveland 15, Ohio, 3121 Euclid Av.
Denver 9, Colo., 1271 West Bayaud Ave.
Detroit, Mich.,800 Marion Av., River Rouge 18.
Greenville, Miss., 815 Main St.
Houston 3, Texas, 2202 Dallas Av.
Jacksonville 3, Fla., P.O. Box 2057.
Kalamazoo 13, Mich., 511 E. Patterson St.
Los Angeles 5, Calif., 2930 W. Sixth St.
Milwaukee 3, Wis., 205 South 14th St.
Minneapolis 13, Minn., 2020 Broadway St. N.E.
New York 6, N.Y. 40 Rector St.
Philadelphia 7, Pa., 12 South 12th St.
Pittsburgh 22, Pa., 3 Gateway Center.
Portland, Ore., P.O. Box 349.
Providence 1, R.I., 98 Weybosset St.
St. Louis 3, Mo., 1221 Locust St.
San Francisco 4, Calif., 235 Montgomery St.
Seattle 1, Wash., 1324-5th Av.
General Controls Co., 801 Allen Av., Glendale 1, Calif.
Atlanta, Ga., 1479 Spring St., N.W.
Baltimore 24, Md., 554 S. Gosling.
Boston 39, Mass., Automatic Controls Co., 347 Boylston, Newton Center.
Buffalo 23, N.Y., 960 Kenmore Av.
Burbank, Calif., 300 W. Alameda Av.
Chattanooga 4, Tenn., 1805 McCallie Ave.
Chicago, Ill., 6800 McCormick Blvd., Skokie, Ill.
Cincinnati 2, Ohio, 307 E. 4th St.
Cleveland 3, Ohio, 4317 Chester Av.
Columbus 12, Ohio, 1219 W. Third Ave.
Dallas 7, Texas, 1804 N. Industrial Blvd.
Denver 4, Colo., 1163 Eliot St.
Des Moines 11, Iowa, 2300 Cottage Grove Ave.
Detroit 27, Mich., 15114 Plymouth Rd.
Hartford, Conn., 410 Asylum St.
Houston 6, Texas, 3067 S. Sandman St.
Indianapolis 22, Ind., 2913 W. 16th St.
Iron Mountain, Mich.
Kansas City 6, Mo., 2904 Oak St.
Los Angeles, Calif., 801 Allen Av., Glendale.
Milwaukee 8, Wis., 3065 W. Vliet St.
Minneapolis 26, Minn., 6522 Walker St.
New Orleans 19, La., 4628 Thalia St.
New York, N.Y., 33-91 Tonnele Av. Long Island City 1, N.Y.
Omaha 2, Nebr., 610 Keeline Bldg.
Philadelphia 4, Pa., 4628 W. Girard Av.
Phoenix, Ariz., 108 S. 4th St.
Pittsburgh 22, Pa., 4 Smithfield St.
Portland 14, Ore., 1480 S.E. Hawthorne Pl.
Salt Lake City 1, Utah, 353 W. 4th St. So.
San Francisco 7, Calif., 680 Bryant St.
Seattle 9, Wash., 767 Broad St.
St. Louis 13, Mo., 1157 N. Union Blvd.
Syracuse 2, N.Y., 317 State Tower Bldg.
Tampa, Fla., 409 E. Cass St.
Tulsa 20, Okla., 1316 S. Peoria Av.
Wichita 2, Kans., 388 N. Broadway.
Guelph, Ontario, Canada, 153 Surrey St. East.
Montreal, Quebec, Canada, 5164 Sherbrooke St., West.
Toronto 1, Ontario, Canada, 73 Simcoe St.
Winnipeg, Manitoba, Canada, 1448 Erin Street.

General Electric Co., 1 River Rd. Schenectady, N.Y.
(Refer to telephone directory for branch offices)
General Ozone Corporation, 315 N. Aberdeen St., Chicago 7, Ill.
Gifford-Wood Co., 1 Hudson St., Hudson, N.Y.
Chicago 6, Ill., 565 W. Washington St.
Cleveland 20, Ohio, 3537 Lee Road.
New York 17, N.Y., 420 Lexington Av.
St. Louis 1, Mo., 1842 Railway Exchange Bldg.
E. D. Goodfellow Co. Inc., 496 E. Dudley Av., Memphis 6, Tenn.
Goulds Pumps, Inc., 500 Fall St., Seneca Falls, N.Y.
Atlanta, Ga., 15 Peachtree Place, N.W.
Boston, Mass., 1330 Beacon St. Brookline, Mass.
Chicago, Ill., 53 W. Jackson Blvd.
Houston, Texas, 2314 Main St.
New York, N.Y., 11 Park Place.
Philadelphia, Pa., 2099 N. 63rd St.
Pittsburgh, Pa., Bessemer Bldg. 104-6th St.
Tulsa, Okla., 543 East Apache St.
Graymills Corp., 3705 N. Lincoln, Chicago 13, Ill.
Great American Industries, Inc., Bedford, Va.
Francis K. Green, C. E., 79-20th St., Irvington, N.J.
Van R. H. Greene, 11 Park Place, New York 7, N.Y.
Grinnell Company, 260 West Exchange St., Providence 1, R.I.
Lyman C. Gross, 432 Sexton Bldg., Minneapolis 15, Minn.
D. W. Haering & Co. Inc., P.O. Box 6037, Harlandale Station, San Antonio 4, Texas.
Alfred Hague & Co. Inc., 227-34th St., Brooklyn 32, N.Y.
Hall Machine Shop, 504 Deming St., New Smyrna Beach, Fla.
Hallett Mfg. Co., 1601 West Florence Av., Inglewood, Calif.
Halstead & Mitchell, Bessemer Bldg., Pittsburgh, Pa.
Hanker & Heyer, Commerce Title Bldg., Memphis 6, Tenn.
Harnischfeger Corp., 4400 W. National Ave. Milwaukee 46, Wis.
Harris Refrigeration Co., 565 Walden St. Cambridge, Mass.
Hastings Instrument Co. Inc., Newcomb Ave. Hampton, Virginia.
Robert E. Hattis, 223 W. Jackson Blvd., Chicago 6, Ill.
R. G. Hautzsch & Sons, 3838 Laclede Ave., St. Louis 8, Mo.
Charles D. Haven, 2913 Goddard Road, Toledo, Ohio.
Havens Structural Steel Co., 1713 Crystal Av. Kansas City 26, Mo.
Hawkins Chemical Company, 3035 E. 7th Place, Los Angeles 21, Calif.
Heatron, Inc., 333 Eberts Lane, York, Pa.
Heat-X, Inc., 1000 Main St., Brewster, N.Y.
Heinemann Electric Co., 128 Plum St., Trenton 2, N.J.
Henry Valve Co., 3215 North Av., Melrose Park, Ill.
Atlanta 8, Ga., C. H. Boyd Company, 150 Pine St. N.E.
Dallas 25, Texas, A.A. Ways, 3920 Wentwood Drive.
Denver 5, Colo., J. N. Marshall Company, 2801 Walnut St.
Los Angeles 24, Calif., Richard S. Dawson Co., 333 Glendale Blvd.
New York 17, N.Y., 5618 Grand Central Terminal Bldg.
San Francisco 3, Calif., Milmac, 280 Seventh St.
Seattle 1, Wash., Northwest Factors, 2609 Second Ave.
Hercshion Steels & Crombie, 39 E. Van Buren St., Chicago, Ill.
Hercules Motors Corp., 101 Eleventh St., Canton 2, Ohio.
A. C. Horn Companies, Div. of Sun Chemical Corp., Horn-Sun Chemical Bldg. Long Island City, N.Y.
George A. Horne, 1198 Myrtle Ave., Plainfield, N.J.
E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Chicago, Ill., 3516 Shields Ave.
Detroit, Mich., 803 Stephenson Bldg.
San Francisco, Calif., 1500 Davidson, Ave.
Howe Ice Machine Company, 2825 Montrose Av., Chicago 18, Ill.
Hubbell Corp., Hawley Road, Box R-700, Mundelein, Ill.
E. F. Huff Co., 3rd & Water Sts., Swedesboro, N.J.
Ice Plant Equipment Co. Inc., 2543 Frankford Av., Philadelphia 25, Pa.
Ideal Electric & Mfg. Co., 330 E. First St., Mansfield, Ohio.
Industrial Mfg. & Engineering Co., 3033 W. Belmont Av., Chicago 18, Ill.
Isotex Corp., 989 Folsom, San Francisco 7, Calif.
Jackes-Evans Mfg. Co., 4427 Carondelet, St. Louis 15, Mo.
Jamison Cold Storage Door Co., Box 70, Hagerstown, Md.
Atlanta, Ga., John W. Parker & Associates, 133 Luckie St., N.W.
Austin, Texas, J. R. Dowdell & Co., 300 West 8th St.
Chicago 10, Ill. 500 N. Dearborn St.
Cincinnati 15, Ohio, Arthur F. Dreyer, P.O. Box 54, Lockland Sta.
Cleveland 15, Ohio, Fielding-Whites Co., 1836 Euclid Ave.
Corpus Christi, Texas, J. R. Dowdell & Co., 1900 North Port Ave.
Dallas 21, Texas, J. R. Dowdell & Co., 4624 Swiss Ave.
Denver 2, Colo., 306 Enterprise Bldg.
Detroit 26, Mich., George S. Crossbeam, 155 W. Congress St.
Honolulu 3, Hawaii, Van Hamm-Young Co. Ltd., P.O. Box 2630.
Houston 2, Texas, J. R. Dowdell & Co., 714 Bastrop St.
Kansas City 11, Mo., A. C. Savidge, Suite 200, 3945 Main St.
Los Angeles 21, Calif., 737 Terminal St. Room 209.
Lubbock, Texas, J. R. Dowdell & Co., 3608 Avenue A.
Minneapolis, Minn., H. O. Johnson, 4805 Garfield Ave. So.
New York 36, N.Y., 11 West 42nd St.
Oklahoma City 7, Okla., R. L. Williams & Co., 2112 Northwest 19th St.
Omaha 2, Nebr., 1116 WOW Bldg.
Philadelphia 41, Pa., E. F. Johnson Co., 5921 N. Broad St.
Pittsburgh 22, Pa., Harry H. Frank, 807 Standard Life Bldg.
Portland 4, Ore., W. H. Cross Company, 201 Concord Bldg.
St. Louis 18, Mo., Louis C. Bewig, 3226 South Grand Av.
Salt Lake City 8, Utah, Louis A. Riser Company, 254 West First South.
San Antonio, Texas, J. R. Dowdell & Co., 722 West Hildebrand Av.
San Francisco 7, Calif., Hayden Equipment Co., 178 Townsend St.
Seattle 99, Wash., Norwest Co., 330-2nd Ave. West.
Spokane 8, Wash., Fryer-Ford Co., Peyton Bldg.
Jarvon Products Inc., 420 N. LaSalle St., Chicago 10, Ill.
J-B-T Instruments, Inc., 441 Chapel St., New Haven 12, Conn.
Jorgensen Cage and Valve Co., 87 Fellowsy, Somerville 45, Mass.
Johns-Manville Corp., 22 E. 40th St., New York 16, N.Y.
Johnson Service Co., 507 E. Michigan St., Milwaukee 1, Wis.
Justrite Manufacturing Co., 2061 N. Southport Av., Chicago 14, Ill.
Thomas C. Kendall, Yuca, Calif.
Kennard Corp., 1819 S. Hanley Road, St. Louis 17.
Carl J. Kiefer Associates, Inc., 26 E. 6th St., Cincinnati 2, Ohio.
Kinetic Chemicals Div., E. I. duPont deNemours & Co., Wilmington 98, Del.
Chicago, Ill, 7 South Dearborn St.
New York, N.Y., 40 Worth St.
Palo Alto, Calif., 535 Cowper St.
King Company, 902-10 N. Cedar St., Owatonna, Minn.
King Zeero Co., 4300 W. Montrose Ave. Chicago 41, Ill.
A. M. Kinney, Inc., Equitor Bldg., Cincinnati, Ohio.
Wm. F. Koelle Sons Inc., 1418 Walnut St., Philadelphia, Pa.
Zane Kogan, 726 W. Sheridan Rd., Chicago, Ill.
Kohlenberger Engineering Co., Fullerton, Calif.
Koppers Company, Inc., Koppers Bldg., Pittsburgh 19, Pa.
Baltimore 3, Md., 2708 Scott St.
Kurland Company, Inc., 40-15 32nd Place, Long Island City 1, N.Y.
Kramer Trenton Co., Olden and Brunig Aves., Trenton 5, N.J.
LaCrosse Cooler Co., 2809-17 Losey Blvd., LaCrosse, Wis.
Ladish Co., 5400 South Packard, Cudahy (Milwaukee Suburb), Wis.
Lake Chemical Co., 3052 W. Carroll Av., Chicago 12, Ill.
Lancaster Pump and Manufacturing Co. Inc., P.O. Box 778, Lancaster, Pa.
Lawrence Pump & Engine Co., Canal & Marston Sts., Lawrence, Mass.
Layne & Bowler, 1993 Chelsea Av., Memphis, Tenn.
Kearney, Nebr., Layne Irrigation Co., P.O. Box 403.
Lubbock, Texas, Layne Pumps, Inc., 4607 Avenue H.
Leeds and Northrup Co., 4970 Stenton Ave., Philadelphia 44, Pa.
C. S. Leopold, 213 S. Broad St., Philadelphia 7, Pa.
Bernard Lester, 140 Cedar St., New York 6, N.Y.
Chas. S. Lewis & Co. Inc., 6625 Grant Road, St. Louis 23, Mo.
Samuel R. Lewis, 431 S. Dearborn St., Chicago 5, Ill.
Lewis-Shepard Products, Inc., 186 Walnut St., Watertown 72, Mass.
Lillie-Hoffmann Cooling Towers, Inc., 1450 S. Vandeventer Av., St. Louis 10, Mo.
Plainview, Texas, 1200 N. Date St.
Lilly Co., 466 Union Ave., Memphis 1, Tenn.
Linde Air Products Co., Div. of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N.Y.
Link-Belt Company, Prudential Plaza, Chicago 1, Ill.
Albany 6, N.Y. 21 Colvin Av.
Atlanta, Ga., 1116 Murphy Av. S.W.
Baltimore 18, Md., 2315 St. Paul St.
Birmingham 9, Ala., 321 Conner Rd.
Boston 15, Mass., 136 Brookline Ave.
Buffalo 25, N.Y., 956 Kenmore Ave.
Cedar Rapids, Iowa, 1201 Sixth St. S.W.
Charlotte 2, N.C., 112 S. Tryon St.
Chicago 9, Ill., 301 W. Pershing Rd.
Cincinnati 2, Ohio, 136 E. Court St.
Cleveland 15, Ohio, 1422 Euclid Ave.
Dallas 21, Texas, 500 Good-Latimer Exp.
Denver 2, Colo., Schloss & Shubert
Detroit 4, Mich., 9936 Linsdale Ave.
Duluth 2, Mich., 301 W. First St.
Grand Rapids 7, Mich., 1350 Burton St. S.E.
Houston 1, Texas, 3303 S. Wayside.
Huntington 1, W. Va., 1009 Fifth Av.
Indianapolis 6, Ind., 320 S. Belmont Av.
Jacksonville 2, Fla., 137 E. Forsyth St.
Kansas City 8, Mo., 2430 Holmes St.
Los Angeles 33, Calif., 361 S. Anderson St.
Louisville 2, Ky., 136 S. Fourth St.
Milwaukee 5, Wis., 600 E. Third St.
Minneapolis 5, Minn., 200 Lyndale Ave.
Moline, Ill, 1614½ Fifth Ave.
Newark 8, N.J., 607 Clinton Av.
New Orleans 12, La., R. J. Tricon Co., 747 Tchoupitoulas St.
New York 7, N.Y., 239 Broadway, Room 3100.
Oakland 7, Calif., 1025 Harrison St.
Philadelphia 40, Pa., 2045 W. Hunting Park Ave.
Pittsburgh 13, Pa., 5030 Centre Ave.
Portland 10, Ore., 5030 N.W. Industrial St.
St. Louis 1, Mo., 317 N. Eleventh St.
Salt Lake City 1, Utah, 168 S. Fourth W. St.
San Francisco 24, Calif., 400 Paul Ave.
Seattle 4, Wash., 3405 Sixth Ave. S.
Shreveport, La., 3109 Alexander St.
Spokane 10, Wash., R. 1305 Washington St.
Washington 7, D.C., 740 Eleventh St. N.W.
Wilmington 43, Del., 805 Orange St.
Lipman Div., Yates American Machine Co., 729 Fourth St., Beloit, Wis.
Arthur D. Little Co., 30 Memorial Drive, Cambridge, Mass.
Allen P. Liver, 60 E. 42nd St., Rm. 445, New York.
Edwin J. Lockwood, 1800 N. Division St., Peekskill, N.Y.
Loewenberg & Loewenberg, 111 W. Monroe St., Chicago, Ill.
Stiles O. Lokey, 1609-2nd Ave. S., Birmingham 3, Ala.
Alex N. Lundicke, Sr., 2379 N. 46th St., Milwaukee 10, Wis.
Lunkenheimer Co., Bostman St. & Waverly Av., Cincinnati 14, Ohio.
Mahle Hydraulic Packing Co., 431 S. Dearborn St., Chicago 5, Ill.
Mahogany Importing Co., 725 South Spring St., Los Angeles 14, Calif.
Maid-O-Mist, Inc., 5217 N. Pulaski Rd., Chicago 41, Ill.
Marion Electrical Instrument Co., Granier Field, Manchester, N.H.
Marley Company, 222 W. Gregory Blvd., Kansas City 14, Mo.
Marlo Coil Co., 6136 Manchester Av., St. Louis 10, Mo.
James P. Marsh Corp., 3501 Howard St., Skokie, Ill.
Mason-Neilan Regulator Co., Norwood, Mass.
Maurey Mfg. Corp., 2907-23 South Wabash Av., Chicago 16, Ill.
McQuay, Inc., 1600 Broadway, N.E., Minneapolis 13, Minn.
Atlanta, Ga., C. G. Baker, 311 Delmont Drive, N.E.
Chicago, Ill., McCullough Engineering Co., 101 E. Ontario St.
Cincinnati, Ohio, D. T. Stillwaither, 9 Briarwood Lane.
Dallas, Texas, Raymond B. Hector, 924 Ryan Road.
Los Angeles, Calif., Townly & Company, 1310 W. 8th St.
Miami, Fla., John W. Bennett, 39 N.E. 4th St.
New York, N.Y., J. W. McGuire Co., 370 Lexington Av.
Portland, Ore., Lyle W. Pandree, 1705 N. Killingsworth.
Springfield, Pa., Bob J. Johnson, 370 E. Springfield Rd.
Merrold Corporation, 4201 Belmont Av., Chicago 41, Ill.
Merlam Instrument Co., 10920 Madison Av., Cleveland 2, Ohio
Franklin P. Miller & Son, Inc., 36 Meadow St., East Orange, N.J.
Miracle Adhesives Corp., 214 E. 53rd St., New York 22, N.Y.
MMBB, Inc., 1315 Hutchins, Houston 1, Texas.
Modern Engineering Corp., 154 Nassau St., New York 7, N.Y.
Moeller Instrument Company, Inc., 132nd & 89th Av., Richmond Hill 18, N.Y.
Molenaar Bros. Co., 4401 W. Ohio St., Chicago 44, Ill.
Mollenberg-Betz Mach. Co. Inc., 28-36 Hamy St., Buffalo 2, N.Y.
Monarch Mfg. Works, Inc., 2501 E. Ontario St., Philadelphia 34, Pa.
Condon E. Moore, Inc., 2811 N. Vermilion St., Danville, Ill.
J. W. Mortell Co., 550 N. Hobbie Av., Kankakee, Ill.
Lyndhurst, N.J., Page & Schuyler Aves.
Van Dyke, Mich., 23333 Sherwood Rd.
Moto-Trac Company, 1953 E. 97th St., Cleveland 3, Ohio
Mundet Cork Corp., 7101 Tonnelle Av., North Bergen, N.J.
Albuquerque, N.Mex., J. Edelo Chants, 5104 Rena Ave., N.E.
Atlanta, Ga., 339 Elizabeth St. N.E.
Chicago, Ill., Howard Mason, 39 E. Wacker Drive.
Cincinnati 2, Ohio, 427 W. Fourth St.
Detroit 38, Mich., 14401 Prairie Ave.
Houston 11, Texas, 6401 Supply Row.
Jacksonville 2, Fla., 520 East Bay St.
Kansas City 1, Mo., 1210 West 9th St.
Los Angeles, Calif., 6116 Walker Avenue, Maywood.

New Orleans 16, La., 315 N. Front St.
New York 17, N.Y., 331 Madison Av.
Philadelphia 39, Pa., 856 North 46th St.
San Antonio, Texas, 130 Lombrano St.
San Francisco, Calif., Victor L. Burner Sr., 440 Brannan St.
St. Louis 9, Mo., 9176 Brannan Avenue.

John H. Magnuson, Inc., 118-06 Farmers Blvd., St. Albans 12, N.Y.

Mystik Adhesive Products, 3638 N. Kildare Av., Chicago 39, Ill.

Nash Engineering Co., South Norwalk, Conn.

National Cork Company, Gar Eagle St., Englewood, N.J.

National Pallet Corp., 947 Oliver Bldg., Pittsburgh 22, Pa.

National Pipe Bending Co., 162 River St., New Haven 13, Conn.
Boston 8, Mass., 110 Tremont St.
New York 7, N.Y., 39 Cortlandt St.

Niagara Blower Company, 405 Lexington Av., New York 17, N.Y.

Nitrogen Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N.Y.
Atlanta 3, Ga., 127 Peachtree St. N.E.
Chicago, Ill., 2000 S. Sacramento Av.
Cleveland 15, Ohio, 3121 Euclid Av.
Columbia, Mo., 20-A South 9th St.
Columbia 1, S.C., 1200 Gervais St.
Hopewell, Va., P.O. Box 131.
Indianapolis 20, Ind., 4060 College Ave.
Trenton, Ohio, P.O. Box 98.
Kalamazoo, Mich., 511 East Paterson St.
Los Angeles 5, Calif., 2999 West 6th St.
Omaha 7, Nebr., P.O. Box 166.
Orange, Texas, P.O. Box 2041.
San Francisco 4, Calif., 235 Montgomery St.
St. Paul 4, Minn., 45 North Snelling Ave.

Nor-Lake, Inc., Hudson, Wis.

North American Mogul Products Co., Standard Bldg., Cleveland, Ohio

Oakite Products, Inc., 19 Rector St., New York 6, N.Y.

J. W. Obrelter, Jr., 14 Lorraine St., Glen Ridge, N.J.

Ohio Galvanizing and Mfg. Co., Ann St., Niles, Ohio

E. H. O'Neill Floors Co., 2525 S. 50th Av., Cicero 50, Ill.

Fred Oplatz, 112 W. 42nd St., New York 36, N.Y.

Owens-Corning Fiberglas Corp., National Bank Bldg., Madison & Huron, Toledo 1, Ohio
Albany, N.Y., 11 N. Pearl St.
Albuquerque, N.Mex., P.O. Box 7067, Old Town Station.
Anchorage, Alaska, Post Road and Ship Creek.
Atlanta 3, Ga., 1726 Fulton Natl. Bank Bldg.
Baltimore 1, Md., Room 409, Baltimore Life Bldg.
Birmingham, Ala., 2229½ First Avenue, N.
Boise, Idaho, 2327 Ark St.
Boston 16, Mass., 820 Statler Office Bldg.
Buffalo 2, N.Y., 401 Hodge Bldg.
Charleston, W.Va., 312 Dorman Bldg.
Charlotte, N.C., 1306 Johnston Bldg.
Chicago 1, Ill., 3236 Pure Oil Bldg.
Cincinnati 6, Ohio, Room 103, 2330 Victory Parkway.
Cleveland 15, Ohio, 1836 Hanna Bldg.
Columbus 15, Ohio, 2118 Leveque-Lincoln Tower
Dallas 4, Texas, 101 United Bankers Life Bldg.
Dayton 2, Ohio, 120 N. Ludlow St., Talbott Bldg.
Denver 1, Colo., P.O. Box 846.
Detroit 2, Mich., 516 New Center Bldg.
Ft. Wayne, Ind., 253 Central Bldg.
Fresno, Calif., 427 "H" St.
Grand Rapids 2, Mich., 424 McKay Tower.
Greensboro, N.C., 221 Watson Bldg.
Greenville, S.C., 216 Rogers Bldg.
Hartford, Conn., 38 A Haviland St.
Houston 19, Texas, 1939 West Gray St.
Indianapolis 4, Ind., 625 Architects & Builders Bldg.
Jacksonville, Fla., Room 420 Atlantic Natl. Bank Bldg.
Kansas City 10, Mo., 2610 Power & Light Bldg.
Knoxville, Tenn., 404 Burwell Bldg.
Los Angeles 5, Calif., 3445 West Eighth St.
Louisville, Ky., 2106 Hahn St.
Memphis, Tenn., 814 Dermon Bldg.
Miami, Fla., 5040 Biscayne Blvd.
Milwaukee 5, Wis., 7140 Plankinton Bldg.
Minneapolis 2, Minn., 1709 Rand Tower.
Mobile, Ala., P.O. Box 995.
Newark 2, N.J., 1025 Broad St.
New Orleans 12, La., 397 Pan-American Life Ins. Bldg.
New York, 22, N.Y., 16 East 54th St., 598 Madison Av.
Norfolk, Va., 810 W. 21st St.
Omaha, Nebr., 250 Keeline Bldg.
Peoria, Ill., 700 First Natl. Bank Bldg.
Philadelphia 9, Pa., 1616 Walnut St. Bldg.
Phoenix, Ariz., 1880 W. Fillmore St.
Pittsburgh 22, Pa., 631 Gateway Center Bldg.
Portland 4, Ore., 1044 Pacific Bldg.
Richmond 19, Va., 1010 Central Natl. Bank Bldg.
Rock Island, Ill., 1907 - 2nd Ave.
Sacramento 14, Calif., 1615 Thornton Ave.
St. Louis 3, Mo., 1006 Olive St.
Salt Lake City, Utah, 336 South Third St., West.
San Antonio, Texas, 595 New Moore Bldg.
San Diego 3, Calif., 3543 Fifth Avenue.
San Francisco 7, Calif., 1200 - 17th St.
San Jose 10, Calif., San Jose Builders' Exchange.
Santa Clara, Calif., P.O. Box 89.
Seattle 4, Wash., 1077 Dexter Horton Bldg.
Spokane, Wash., 3044 E. Trent Ave.
Syracuse, N.Y., 218 Harrison St.
Tulsa, Okla., 902 American Airlines Bldg.
Washington 6, D.C., Rm. 209, 908 Connecticut Ave., N.W.
Wichita, Kans., 16 East 56th St.
International Division, 16 East 56th St., New York City.

Pacific Lumber Co., 100 Bush St., San Francisco 4, Calif.

Pacific Transducer Corp., 11836 West Pico Blvd., Los Angeles 64, Calif.

Pallton, Inc., 40 W. 29th St., New York 1, N.Y.

Pallets, Incorporated, 60 Pearl, Hudson Falls, N.Y.

Paragon Electric Co., 1601 - Twelfth St., Two Rivers, Wis.

Parks Cramer Co., Newport St., Fitchburg, Mass.
Atlanta 1, Ga., P.O. Box 1355.
Charlotte 1, N.C., P.O. Box 10276.

Partlow Corp., 2 Campion Road, West Hartford, N.Y.

Horace M. Patrick, 20 Olcott Av., Bernardsville, N.J.

Patterson & Davis, 418 West Olney Av., Philadelphia 20, Pa.

Patterson-Kelly Co., Inc., 4285 Warner Av., East Stroudsburg, Pa.
Boston, 16, Mass., 96-A Huntington Ave.
Chicago 4, Ill., Railway Exchange Bldg.
New York 17, N.Y., 101 Park Av.
Philadelphia 3, Pa., 1700 Walnut St.

V. C. Patterson & Associates, Inc., 415 W. Market St., York, Pa.

Pavlant Prod. Div., United Cooling Towers, Inc., 1421 E. Washington Av., North Little Rock, Ark.
Chicago, Ill., 224 S. Michigan.
Denver, Colo., 2601 W. 37th St.
Des Moines, Iowa, 4110 Greenwood Drive.
Detroit, Mich., 17400 Wisconsin.
Greenville, S. C., 104 E. Stone Av.
Los Angeles, Calif., 1726 Maltman Av.
Memphis, Tenn., P.O. Box 5853.
Miami, Fla., 815 N.W. 144th St.
Nashville, Tenn., Third Natl. Bank Bldg.
New Orleans, La., 840 Baronne St.
New York, N.Y., 21 West Street.
Omaha, Nebr., Box 26, Elmwood Sta.
Pittsburgh, Pa., 894 Heckler Drive.
Somerville, Mass., 99 Highland Ave.
St. Louis, Mo., 5909a Coronado.

Pennsylvania Salt Manufacturing Co., 3 Penn Center Plaza, Philadelphia 2, Pa.
Appleton, Wis., Irving Zuelke Bldg.
Chicago 1, Ill., 1216 Builders' Bldg.
Cincinnati 2, Ohio, 1828 Carew Tower Bldg.
Cleveland 15, Ohio, Hanna Bldg.
Decatur, Ga., 522 N. McDonough St.
Detroit 26, Mich., 2328 Buhl Bldg.
Paterson 1, N.J., 152 Market St.
Pittsburgh 19, Pa., 254 Alcoa Bldg.
St. Louis 5, Mo., 10 Brentwood Blvd.

Perfection Ice Scoring Machine Co., P.O. Box 2140, Fort Worth, Texas

Permanix Corp., 228 North LaSalle St., Chicago 1.

Permatex Co., 330 W. 42nd St., New York 36, N.Y.

Howard H. Peterson, 651 Miller Bldg., Yakima, Wash.

H. A. Phillips & Co., 3255 W. Carroll Av., Chicago 24, Ill.
Los Angeles, Calif., C & S Equipment Co., 2103 S. San Pedro.
Seattle, Wash., Mason Emanuels Co., 908 A Elliott Ave.

Pittsburgh Corning Corp., One Gateway Center, Pittsburgh 22, Pa.
Chicago 6, Ill., 205 W. Wacker Drive.
Kansas City 9, Mo., 10- West 11th St.
New York 17, N.Y., 579 Fifth Ave.
Philadelphia 2, Pa., 225 S. Fifteenth St.
Toronto, Ontario, Canada, 57 Bloor Street, West.

James Posey, 10 E. Pleasant St., Baltimore 2, Md.

Powers Regulator Co., 3400 Oakton St., Skokie, Ill.

Prestite-Keystone Engineering Products Co., 3730 Chouteau Av., St. Louis 10, Mo.

J. F. Pritchard & Co. of California, 4625 Roanoke Parkway, Kansas City 12, Mo.

Quigley Co., Inc., 415 Madison St., New York 17, N.Y.

Ready Power Co., 11231 Freud Av., Detroit 14, Mich.

Recoy Products Co. Div. of Schenkmair Mfg. Co., Kittle Rd., Holland, Ohio

Reflectal Corp., 310 S. Michigan, Chicago 4, Ill.

Refrigerating Specialties Co., 3004 W. Lexington, Chicago 12, Ill.

Refrigeration Appliances, Inc., 911 W. Lake St., Chicago 7, Ill.

Refrigeration Engineering Co., 2016 Foshay Tower, Minneapolis, Minn.
Montgomery, Minn.

Refrigeration Engineering, Inc., 7250 E. Slauson Av., Los Angeles 22, Calif.

Paul T. Regan, 656 - 31st St. at Grove, Oakland 9, Calif.

J. C. Rehard, Thermokair Engineering Co., 20080 James Couzens Hy., Detroit 35, Mich.

Louis P. Reiss, 6900 Bob-O-Link Dr., Dallas 4, Texas

Reliance Electric & Engineering Co., 1088 Ivanhoe Road, Cleveland 10, Ohio

Reliance Refrigerating Machine Co., 3401 N. Kedzie Av., Chicago 18, Ill.

Remco Co., 540 N. Sacramento Blvd., Chicago 12, Ill.

Research Products Corp., 1015 E. Washington Av., Madison 10, Wis.
Abington, Pa., Curtis H. Sidenberg, Shawtown Rd.
Denver 11, Colo., E. P. Murr, 2542 W. 26th Av.
Fresno 3, Calif., Norman S. Wright & Co., 1361 Abby St.
Los Angeles 26, Calif., Norman S. Wright & Co., 625 North Alvarado St.
Nashville, Tenn., Louis Owen, P.O. Box 1266.
New York 17, N.Y., James W. McGuire, 370 Lexington Av.
Phoenix, Ariz., Norman S. Wright & Co., 2645 East Adams.
Pittsburgh 6, Pa., B. L. Ruhlen, Inc., 141 South Highland Av.
Portland 4, Ore., Norman S. Wright & Co., 1932 S.W. Water St.
Raleigh, N.C., L. R. Carroll, P.O. Box 5743.
Richmond 20, Va., Hugh R. Neal, 791 Brook Rd.
Sacramento, Calif., Norman S. Wright & Co., 512-20th St.
San Francisco 3, Calif., Norman S. Wright & Co., 1015 Folsom St.
Seattle 9, Wash., Norman S. Wright & Co., 235-9th Av. North.
Somerville 43, Mass., Proven Products Distributors, 66 South St.
Spokane 4, Wash., Norman S. Wright & Co., South 125 Stevens.
Tampa 1, Fla., Industrial Specialties Sales, Box 1335.
Washington 11, D.C., Lyle Howe, 6230 Third St., N.W.

Reynolds Electric Co., 3000 River Road, River Grove, Ill.

Reynolds Mfg. Co., Springfield, Mo.

Rex Engineering & Sales Co., P.O. Box 5141, Oklahoma City 7, Okla.

Robbins & Myers, Inc., 1345 Lagonda Av., Springfield, Ohio
Chicago 35, Ill., 1829 N. Harlem Av.
Cleveland 14, Ohio, 221 Leader Bldg.
New York 7, N.Y., 57 Murray St.
Kansas City 8, Mo., Room 361, 30 Union Station Plaza.

Robertshaw-Fulton Controls Co., 2920 N. Fourth St., Philadelphia, Pa.
See Fulton-Sylphon Div. for branch offices

Rochester Manufacturing Co. Inc., Rockwood St., Rochester 10, N.Y.

Roessing Manufacturing Co., 1616 Noble St., Sharpsburg, Pittsburgh 15, Pa.

Roots Connersville Blower Div., Dresser Industries, Inc., 900 W. Mount St., Connersville, Ind.

Rotometals, 980 Harrison St., San Francisco 7, Calif.

Ruggles-Klingemann Mfg. Co., Foster Court, Salem, Mass.

Rupprecht's Rotary Roof Cooler, P.O. Box 6795, Los Angeles 22, Calif.

Rust Engineering Co., 2109 - 5th Av., N. Birmingham 3, Ala.

Rutherman Machinery Co., 1809 Reading Road, Cincinnati 2, Ohio

Safety Seal Piston Ring Co., P.O. Box 106, Fort Worth 1, Texas

Alfred R. Salzer, 804 Queen & Crescent Bldg., New Orleans, La.

S & S Vending Machine Co., 670 Lincoln Av., San Jose, Calif.

Schaummaier Mfg. Co., Kittle Road, Holland, Ohio

Schmidt, Garden & Erikson, 104 S. Michigan Av., Chicago, Ill.

Schnacke, Inc., 1101 N. Governor, Evansville 7, Ind.

Schoolfield Mfg. Co., 312 N. Third St. at Upham, Madison 10, Wis.

Schutte & Koerting Co., Cornwells Heights, Pa.

Sealol Corporation, Warwick Industrial Park, Providence 5, R.I.

Serdex, Inc., 91 Cambridge St., Boston 14, Mass.

Shaats Engineering Co., 3216 Chestnut St., Philadelphia 4, Pa.

Cyrus Shaub Company, 4600 W. 12th Place, Chicago 50, Ill.

R. H. Sheppard Company, Inc., 101 Philadelphia St., Hanover, Pa.

Edward Simons, 3152 - 20th Av., San Francisco, Calif.

Skylrite Co., 3125 Perkins Av., Cleveland 14, Ohio

Sleet-Fin Radiator Corp., 87 - 130th St. Richmond Hill 18, N.Y.

Smith, Bridaker & Egan, 30 N. LaSalle St., Chicago, Ill.

James M. Smith, 251 Kearny St., San Francisco, Calif.

Foster D. Snell Inc., 29 W. 15th St., New York 11, N.Y.

Solvay Process Division, Allied Chemical & Dye Corp., 61 Broadway, New York 6, N.Y.

Spencer Chemical Co., 610 Dwight Bldg., Kansas City, Mo.

Spartan Valve Co., 7525 Sussex Av., St. Louis 17, Mo.

Spraying Systems Co., 3201 Randolph St., Bellwood, Ill.

W. A. Staine, 521 E. Valencia, Burbank, Calif.

Standard Refrigeration Co., 332 S. Hoyne Av., Chicago 12, Ill.

Star-Kimble Motor Division, Kimble Printing Press & Mfg. Co., 200 Bloomfield Av., Bloomfield, N.J.

Wm. Steinen Mfg. Co., 43 Brook St., Newark 5, N.J.

Sterling Lumber & Supply Co., 11900 S. Halsted St., Chicago 28, Ill.
Goodwater, Alabama

J. W. Stockton, 84 Covington St., S.W., Washington 20, D.C.

F. J. Stokes Machine Co., 5500 Tabor Road, Philadelphia, Pa.

William E. Stone, 1350 Dearborn St., Seattle 44, Wash.

Streator Products Corp., 408 North Depot St., Fairfield, Iowa

Sun Chemical Corp., Non-Sun Chemical Bldg., Long Island City, N.Y.

Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

Superior Valve & Fittings Co., 1509 W. Liberty Av., Pittsburgh 26, Pa.
Atlanta 8, Ga., 732 Spring St.
Bergenfield, N.J., 405 S. Washington Av.
Houston 6, Texas, 2601 Grant St.
Los Angeles 7, Calif., 2707 S. Hill St.
Minneapolis 16, Minn., 6524 Walker St.
River Grove, Ill., 8219 West Grand Av.
St. Louis 22, Mo., 301 N. Sappington Rd.

Taco Heaters, Inc., 137 South St., Providence 9, R.I.

Leslie S. Tarleton, C.E., 1580 Walnut St., Philadelphia, Pa.

Taylor Instrument Companies, 95 Ames St., Rochester 1, N.Y.
Amarillo, Tex.
Atlanta 3, Ga.
Baltimore 11, Md.
Boston 92, Mass.
Buffalo 17, N.Y.
Charlotte, N.C.
Cincinnati 9, Ohio.
Cleveland 14, Ohio.
Columbus 15, Ohio.
Denver 2, Colo.
Detroit 16, Mich.
Greensboro, N.C.
Houston 11, Tex.
Indianapolis 5, Ind.
Jacksonville, Fla.
Knoxville, Tenn.
Los Angeles 39, Calif.
Memphis 11, Tenn.
Milwaukee 16, Wis.
Minneapolis 16, Minn.
New Orleans 20, La.
Oak Park, Ill.
Omaha 2, Nebr.
Philadelphia 3, Pa.
Pittsburgh 16, Pa.
Portland 5, Ore.
San Leandro, Calif.
Seattle, N.Y.
Seattle 1, Wash.
Silver Springs, Md.
St. Louis 8, Mo.
Syracuse 5, N.Y.
Tulsa 3, Okla.
West Springfield, Mass.
Wilmington 1, Del.
Calgary, Canada
Montreal, Canada
Toronto, Canada
Vancouver, Canada
Winnipeg, Canada
London, England
Melbourne, Australia
New York 20, N.Y.

Taylor Made Ice Vending Mfg. Co., Highway 82 East, Eupora, Miss.
Monroe, La., 1002 Ouachita Bank Bldg.

Technifilter Corp., Port Jervis, N.Y.

Temprite Products Corp., East Maple Road, P.O. Box 72 Birmingham, Mich.

Tenney Engineering Inc., 1900 Springfield St., Union, N.J.
Baltimore, Md., 2235 Sisson St.

Texas Co., 135 E. 42nd St., New York 17, N.Y.

Thermal Agency, 2515 Dallas, Houston 3, Texas

Parks H. Thompson, 218 N. Dickson St., Kirkwood 22, Mo.

Tiderider, Inc., 112 East Sunrise Highway, Freeport, N.Y.

James M. Todd, 3141½ Dauphin St., New Orleans 16, Tas-Tex Corporation, 247 Pearl St. N.W., Grand Rapids 2, Mich.

TOT Towers, Inc., 5220 Lawndale, P.O. Box 2564, Houston, Texas

Trane Co. 286 Cameron Av., LaCrosse, Wis.

Trenton Manufacturing, Inc., Kold-Hold Div., 735 E. Hazel St., Lansing 4, Mich.

Tropical Paint Company, 1246 W. 70th St., Cleveland 2, Ohio

Tubacex Company, Inc., 548 Tuscarora Bldg., East 5th and Locust, Des Moines 9, Iowa

J. Gordon Turnbull Inc., 2630 Chester Av., Cleveland.

Tuttle & Bailey, Inc., 1700 Corbin Av. New Britain, Conn.
Chicago 10, Ill., 61 W. Kinzie St.
New York 17, N.Y., 420 Lexington Av.
Philadelphia 40, Pa., 902 West Lycoming St.

Typhoon Air Conditioning Co., 585 Carroll St., Brooklyn 15, N.Y.

Ushling Instrument Company, 473 Getty Av., Paterson 3, N.J.

Union Asbestos & Rubber Co., 2900 W. Vermont Ave., Blue Island, Ill.

Union Canvas Goods Co., 308 W. Cumberland St., Philadelphia 33, Pa.

Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N.Y.

Union Lumber Company, 650 Market St., San Francisco 4, Calif.

United Cooling Towers Inc., 1421 E. Washington Ave., See Peerless Prod. Div. for branch offices.

United Cork Companies, Kearny, N.J.

U. S. Air Conditioning Corp., Refrigeration Div., 7900 Tabor Rd., Philadelphia 11, Pa.

United States Hoffman Corporation, 105 Fourth Av., New York 3, N.Y.

U. S. Thermo Controls Co., 44 South 12th St., Minneapolis 3, Minn.

Velocity Power Tool Co., 201 N. Braddock Ave., Pittsburgh 8, Pa.

Herman Vetter, 438 Chamber of Commerce Bldg., 1151 S. Broadway, Los Angeles 15, Calif.

Vibration Mountings, 98 - 50th Av., Corona 69, N.Y.

Vilter Manufacturing Company, 2217 South First St., Milwaukee 7, Wis.
Atlanta, Ga., 267 E. Paces Ferry Rd. N.E.
Chicago 10, Ill., 230 W. Superior St.
Cincinnati 2, Ohio, 6 E. Fourth St., Rm. 804
Minneapolis 2, Minn., 1202 Foshay Tower.
New York 17, N.Y., 110 E. 42nd St., Rm. 1407.
Philadelphia, Pa., 20 W. Lancaster Av., Ardmore, Pa.
St. Louis, Mo., 1118 Fullerton Bldg.

Virginia Smelting Co., West Norfolk, Va.

Henry Vogt Machine Co., 1000 West Ormsby St., Louisville 10, Ky.
Chicago 3, Ill., 111 W. Monroe St., 2023 Harris Trust Bldg.
Cleveland 14, Ohio, 710 Williamson Bldg.
Dallas, Texas., 311 South Akard.
New York 4, N.Y., 80 Broad St., 3110 Maritime Exchange Bldg.
Philadelphia, Pa., 1339 Commercial Trust Bldg.
St. Louis 17, Mo., Suite 200, 6611 Clayton Rd.

J. N. H. Voss Co. Inc., 705 E. 144th St., New York 54, N.Y.

Wagner Electric Corp., 6400 Plymouth Ave., St. Louis.

Warren Steam Pump Co., Inc., 11 Bridge Av., Warren, Mass.

Lloyd L. Wartes, 900 W. 7th St., Spokane 9, Wash.

Water Cooling Corporation, 71 Nassau St., New York 38, NY.

Wyandotte Chemicals Corp., Wyandotte, Mich.

D. H. Wyatt, 123 Acton Road, Columbus 2, Ohio.

Yates American Machine Co., 729 Fourth St. Beloit, Wis.

York Corporation, York, Pa.
Atlanta 2, Ga., 412 Houston St. N.E.
Baltimore 17, Md., 700 N. Pulaski St.
Birmingham, Ala., 1221 Concord Av.
Boston 16, Mass., 31 St. James Ave.
Charlotte, N.C., 501 E. Morehead St.
Chattanooga, Tenn., 3822 Mission View Ave.
Chicago 1, Ill. 185 N. Wabash Av.
Chicago, Ill., 1113 Cornelia Ave.
Cincinnati 2, Ohio, Daylight Bldg., 659 E. 6 St.
Cleveland 13, Ohio, 2700 Washington Ave. N.W.
Columbus 11, Ohio, 2910 Gerbert Rd.
Dallas 1, Texas, 1239 National City Bldg.
Denver 2, Colo., 650-17th St.
Detroit 2, Mich., 3924 Second Blvd.
Erie, Pa., 616 Delaware Ave.
Fort Worth 4, Texas, 2548 Wabash St.
Houston 1, Texas, 2201 Texas Ave.
Indianapolis 4, Ind., 899 Massachusetts Ave.
Kansas City 2, Mo., 107 W. Linwood Blvd.
Knoxville, Tenn., 5925 Holston Hills Rd.
Los Angeles 58, Calif., 5051 Santa Fe Ave.
Louisville 7, Ky., 4318 Briarwood Rd.
Memphis 3, Tenn., 46 N. 3rd.
Milwaukee 2, Wis., 312 E. Wisconsin Ave.
Minneapolis 11, Minn., 225 S. Fifth St.
New Orleans 12, La., 301 Delta Bldg.
New York 17, N.Y., 100 E. 42nd St.
North Canton, Ohio, 630 W. Maple St.
Omaha 8, Nebr., 1213 Jackson St.
Orlando, Fla., 318 E. Princeton Ave.
Peoria 2, Ill., 712 Commercial Natl Bank Bldg.
Philadelphia 2, Pa., 1230-46 North 44th St.
Pittsburgh 22, Pa., 7 Ferry St.
Portland 4, Ore., Cascade Bldg., S.W.
Richmond 20, Va., 311 W. Grace St.
Rochester 5, N.Y., 471 St. Paul St.
San Antonio 9, Texas, 808 Frost Natl. Bank Bldg.
San Francisco 3, Calif., 1275 Folsom St.
Savannah, Ga., R.F.D. 3, Cedar Hammock.
Seattle 9, Wash., 1202 Harrison St.
St. Albans, W. Va., 1919 Parkview Dr.
St. Louis 2, Mo., 117 S. 11th St.
St. Paul W4, Minn., 1952 University Ave.
Tulsa, Okla., 327 Mayo Bldg.
Washington 6, D.C., 1014 duPont Circle Bldg.
Yakima, Wash., 218 Ward Bldg.

Young Radiator Company, 709 Marquette St., Racine, Wis.

Zanolite Company, 135 S. LaSalle St., Chicago 3, Ill.

Water Cooling Equipment Co., 3601 New Hampshire Av. St. Louis 23, Mo.

Water Treatment Engineers, P. O. Box 2968, Cleveland, Ohio.

J. E. Watkins Co., 307 Lake St. Maywood, Ill.

Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

Weston Electrical Instrument Corp., 614 Frelinghuysen Av. Newark 5, N.J.
Chicago 6, Ill., 205 W. Wacker Drive.
Los Angeles 7, Calif., 2801 South Grand Av.
New York 7, N.Y. 50 Church St.
Washington 4, D.C., 425-13th St. N.W.

Whitlock Manufacturing Co., 126 South St. Elmwood, West Hartford 10, Conn.

J. H. Wichenhaus, 14 S. Duke St., Lancaster, Pa.

G. E. Wieland, 6617 Dawson Av. Seattle, 8, Wash.

Wilcox & Williams Co., 130 Lincoln St. Brighton 35, Boston, Mass.

Wilder Mfg. Co., Inc., Mechanic Street and Erie R. R., Port Jervis, N.Y.

E. T. Williams, C. L., 32 W. 48th St., New York.

Thomas C. Wilson, Inc., 21-11 44th Av. Long Island City 1, N.Y.

Wingate Mfg. Co., Dixie Road, Charlotte, N. C.

A. H. Witt Co., 940 N. Sycamore Av., Los Angeles.

Wolf Condenser Works, 709 Hart St., Brooklyn, N.Y.
Queens Village, L.I., N.Y., 80-42 222nd St.

James K. Wolford, 2941 N. Charles, Baltimore 18.

Worthington Corp., 421 Worthington Av. Harrison, N. J.

Wright Chemical Corporation, 627 W. Lake Chicago.
Casper, Wyo., P.O. Box 2235.
Dallas, Texas, 4607½ Tremont St.
Detroit 26, Mich., 424 Book Bldg.
Houston, Texas, 2204 Fannin St.
Kansas City, Mo., 7912 Prospect Av.
Lakeland, Fla., P.O. Box 2696.
Memphis 9, Tenn., 265 E. Brooks Ave.,
Milwaukee, Wis., Jos. S. Babush Co., 2401 N. Maryland.
Mobile, Alabama, P.O. Box 1325.
Mooresville, Ind., 98 West Morgan.
New Orleans, La., 321 Newman Av.
New York City, N.Y., 32 Vanderbilt Av.
North Hollywood, Calif., 7041 Mary Ellen Ave.
Philadelphia 7, Pa., 801 Western Saving Bldg.
Phoenix, Ariz., 1814 W. Van Buren St.
Pueblo, Colo., 421 Dittner
San Francisco, Calif., 742 Market St.
Seattle, Wash., 616 Arctic Bldg.
St. Louis, Mo., 34 N. Brentwood Blvd.
Tulsa, Okla., 1218 South Elgin.
Williamsville 21, N.Y., 235 South Forest Road.
Wyoming, Cincinnati 15, Ohio, 126 E. Mills Ave.

Trade Names of Products

REFER TO PAGE 49 FOR COMPLETE ADDRESSES

A

ABSORBITE—Barnsby-Cheney Co., Columbus, Ohio

ACI—American Coils Co., Newark, N. J.

ACRAWATT—Acra Electric Corp., Franklin Park, Ill.

AIRCLEAR OZONE GENERATORS—General Ozone Corp., Chicago, Ill.

AEROFUSE—Tuttle & Bailey Inc., New Britain, Conn.

AEROPASS—Niagara Blower Co., New York, N. Y.

AEROVANE—Tuttle & Bailey Inc., New Britain, Conn.

AIRCO—Air Reduction Sales Co., New York, N. Y.

AIR-LEC DOOR OPERATORS—Schoettkopf Mfg. Co., Madison, Wis.

AIRSERCO—Airserco Mfg. Co., Pittsburgh, Pa.

AIRTEMP—Airtemp Div., Chrysler Corp., Dayton, Ohio

ALCO—Alco Valve Co., St. Louis, Mo.

ALUMALOY—Research Products Corp., Madison, Wis.

ALUMISATIN—Aluminoid Corp., New York, N. Y.

ALUMISEAL—Aluminoid Corp., New York, N. Y.

AMERICAN MARSH—American Marsh Pumps Inc., Battle Creek, Mich.

AMPCOLD—American Plate Freezer Corp., E. Boston, Mass.

ANCO—Anderson Chemical Co., Macon, Ga.

ANDRITE—Acmal Chemical Co., Marinette, Wis.

ANEMOSTAT AIR DIFFUSER—Anemostat Corp. of America, New York, N. Y.

ANEMOTHERM AIR METER—Anemostat Corp. of America, New York, N. Y.

ANGLE COMPRESSORS—Clark Bros. Co., Olean, N. Y.

ANSUL—Ansul Chemical Co., Marinette, Wis.

APEX-USHLING—Ushling Instrument Co., Paterson, N. J.

AQUA—Aqua Electric Scale Control Inc., Cleveland, Ohio

ARMAFLEX—Armstrong Cork Co., Lancaster, Pa.

ARMALITE—Armstrong Cork Co., Lancaster, Pa.

ARMOUR AMMONIA—Armour and Company, Chicago, Ill.

ARMSTRONG—Armstrong Machine Works, Three Rivers, Mich.

ARTIC METHYL CHLORIDE—E. I. DuPont de Nemours & Co., Wilmington, Del.

ASCO—Automatic Switch Co., Orange, N. J.

ASPER-JET—Thermal Agency, Houston, Texas

ATCORETER—Automatic Temperature Control Co., Philadelphia, Pa.

ATCORNIC—Automatic Temperature Control Co. Philadelphia, Pa.

ATCOTRAN—Automatic Temperature Control Co., Philadelphia, Pa.

ATCOTROL—Automatic Temperature Control Co., Philadelphia, Pa.

ATLAS—Atlas Valve Co., Newark, N. J.

AURORA APCO—New York Air Brake Co., Aurora Pump Div., Aurora, Ill.

AUTO-LITE—Electric Auto-Lite Co., Instrument & Gauge Division, Toledo, Ohio

B

BAC—Baltimore Aircoil Co. Inc., Baltimore, Md.

BAC—Brewer Mfg. Co., Utica, N. Y.

BAGAC—Mahogany Importing Co., Los Angeles 14, Calif.

BAND-IT—Band-It Co., Denver, Colo.

BANTAM—Samuel S. Gelber Co., Chicago, Ill.

BARRELED SUNLIGHT—Barreled Sunlight Paint Co., Providence, R. I.

BARRETT BRAND—Nitrogen Div., Allied Chemical & Dye Corp., New York, N. Y.

BARRYMOUNT—Barry Controls Inc., Watertown, Mass.

B & G—Bell & Gossett Co., Morton Grove, Ill.
BITUMULS—American Bitumuls & Asphalt Co., San Francisco, Calif.
BITUSIZE—American Bitumuls & Asphalt Co., San Francisco, Calif.
BLO-COLD—Acme Industries, Jackson, Mich.
BLUE BIRD—LaCrosse Cooler Co., LaCrosse, Wis.
BOND TITE—Baldwin-Hill Co., Trenton, N. J.
BOWER BRAND—Henry Bower Chemical Co., Philadelphia, Pa.
B-P TEMPLETS—Barada & Page, Inc., Kansas City, Mo.
BRAKE MOTORS—Cleveland Electric Motor Co., Cleveland, Ohio
BRISTOL'S—The Bristol Co., Waterbury, Conn.
BRUNDAGE—Brundage Co., Kalamazoo, Mich.
BRUNNER—Brunner Mfg. Co., Utica, N. Y.
BRUNNER-METIC—Brunner Mfg. Co., Utica, N. Y.
BRYANT—Carrier Corp., Syracuse, N. Y.
BURLING—Burling Instrument Co., Chatham, N. J.
BUSH—Dunham-Bush Inc., West Hartford, Conn.
BUSS—Bussmann Mfg. Co., St. Louis, Mo.
BUTCHER BOY—Butcher Boy Refrigerator Door Co., Harvard, Ill.

C

CALADOBE—American Bitumuls & Asphalt Co., San Francisco, Calif.
CAL-FIN TUBING—Drayer-Hanson Inc., Los Angeles, Calif
CALGON—Calgon, Inc., Pittsburgh, Pa.
CANDOR—Candor Engineering Co., Montclair, N. J.
CAN-O-GAS—Virginia Smelting Co., West Norfolk, Va.
CARBO-COOLERS—Mojonnier Bros. Co., Chicago, Ill.
CARBOLINEUM—Carbolineum Wood Preserving Co., Milwaukee, Wis.
CAR-CEL—Dole Refrigerating Co., Chicago, Ill.
CASH ACME—A. W. Cash Valve Mfg. Corp., Decatur, Ill.
CASH STANDARD—A. W. Cash Co., Decatur, Ill.
CAT—Caterpillar Tractor Co., Peoria, Ill.
CATCH-ALL—Sporlan Valve Co., St. Louis 17, Mo.
CAUSUL—Lunkenheimer Co., Cincinnati, Ohio
CB—Cleaver Brooks Co., Milwaukee, Wis.
CEL-LINE—Dole Refrigerating Co., Chicago, Ill.
CEMENTKOTE—Tropical Paint Co., Cleveland, Ohio
CENTRAVAC—Trane Co., La Crosse, Wis.
CERFAX—E. F. Houghton & Co., Philadelphia, Pa.
CERTIFIED CLIMATE—Parks Cramer Co., Fitchburg, Mass.
CHASE—Chase Brass & Copper Co., Waterbury, Conn.
CHEMISOL—Chemisol Inc., Elizabeth, N. J.
CHEMCO—Chemical Engineering Co., Dallas, Texas
CHEVRON—The Garlock Packing Co., Palmyra, N. Y.
CHICAGO—Chicago Blower Corp., Franklin Park, Ill.
CHILLJET—Industrial Mfg. & Engineering Co., Chicago, Ill.
CHILLVACTOR—Croll-Reynolds Co., New York, N. Y.
CLARK—Clark Bros. Co., Olean, N. Y.
CLE-MATIC MOTORS—Cleveland Electric Motor Co., Cleveland, Ohio
CLERTEMPICE—Dorn Refrigeration Co., Chicago, Ill.
COLD-CEL Dole Refrigerating Co., Chicago, Ill.
COLDJET—Industrial Mfg. & Engineering Co., Chicago, Ill.
COLDMOBILE—Coldmobile Division, Union Asbestos & Rubber Co., Bloe Island, Ill.
COL-FLAKE—Col-Flake Corp., Chicago, Ill.
COLUMBIA—Columbia Electric Mfg. Co., Cleveland, Ohio
CONDUIT WEATHERMASTER SYSTEM — Carrier Corp., Syracuse, N. Y.
CONVERT-TO-COOL—Typhoon Air Conditioning Co., Brooklyn, N. Y.
COOLMASTER—Kramer Trenton Co., Trenton, N. J.
COR-IN—Rotometals, San Francisco 7, Calif.
COSMOLUB-RIC—E. F. Houghton & Co., Philadelphia, Pa.
CROLOY—Babcock & Wilcox Co., Beaver Falls, Pa.
CSCO—Chemical Solvent Co., Birmingham, Ala.
CURVETTE—Kramer Trenton Co., Trenton, N. J.
CUSTOM-MOLDED—Mundet Cork Corp., North Bergen, N. J.

D

DACOR—Barnsby-Cheney Co., Columbus, Ohio
DAMPCORT ENAMELS—Willer & Williams Co., Boston, Mass.
DAY & NIGHT—Carrier Corp., Syracuse, N. Y.
DEAN—Dean Products, Inc., Brooklyn, N. Y.
DEAN COLD PLATES—Dean Products, Inc., Brooklyn, N. Y.
DEFROSTAIRE—A. H. Witt Co., Los Angeles, Calif.
DE-FROST-IT—Paragon Electric Co., Two Rivers, Wis.
DEMING—The Deming Co., Salem, Ohio
DEODORITE—Barnsby-Cheney Co., Columbus, Ohio
DESOMATIC—Desomatic Products Inc., Falls Church, Va.
DETROIT—Detroit Controls Corp., Detroit, Mich.
DIMCO—Detroit Ice Machine Co., Detroit, Mich.
DISTILEX—Chemical Solvent Co., Birmingham, Ala.
DOLE—Dole Refrigerating Co., Chicago, Ill.
DOREX—Connor Engineering Corp., Danbury, Conn.
DOWEX—Dow Chemical Co., Midland, Mich.
DOWFLAKE—Dow Chemical Co., Midland, Mich.
DOZ-ALL—Fine Products Co., Berwyn, Ill.
DRUMGOLD & GLENR—Coldmobile Division, Union Asbestos & Rubber Co., Blue Island, Ill.
DRY-EYE—Ansul Chemical Co., Marinette, Wis.
DRY-EX—Acme Industries, Jackson, Mich.
DRYOMATIC—Dryomatic Corp., Alexandria, Va.
DUCTATHERM—Mercoid Corp., Chicago, Ill.
DUO-PASS—Niagara Blower Co., New York, N. Y.
DURAMETALLIC—Durametallic Corp., Kalamazoo, Mich.
DURA PLASTIC—Durametallic Corp., Kalamazoo, Mich.
DURASEAL—Durametallic Corp., Kalamazoo, Mich.

E

ECLIPSE—Frick Company, Waynesboro, Pa.
E C & M—Electric Controller & Mfg. Co., Cleveland, Ohio
EEZION—Paiton, Inc., New York City, N. Y.
ELASTIKOTE—Tropical Paint Co., Cleveland, Ohio
ELASTO-RIB—Korfund Co. Inc., Long Island, N. Y.
ELECTRIMATIC—James P. Marsh Corp., Skokie, Ill.
ELECTRO-MARINE—Bushings Inc., Royal Oak, Mich.
ELECTROMAK—Leeds and Northrup Co., Philadelphia.
ENAMELITE—Pressite-Keystone Engineering Products Co., St. Louis, Mo.
ESKIMO—Ballard Sales Co., Fort Worth, Tex.
EVAPOTROL—Alco Valve Co., St. Louis, Mo.
EXIDE—Exide Industrial Division, Electric Storage Battery Co., Philadelphia, Pa.
EZ KLEEN—Research Products Corp., Madison, Wis.
E-Z OPEN—Jamison Cold Storage Door Co., Hagerstown, Md.

F

FABRI FLEX—Vibration Mountings Inc. Corona, N. Y.
FACT-O-CRETE—E. H. O'Neill Floors Co., Cicero, Ill.
F & E AUTOMATIC ICE CUBES—Flynn and Emrich Co., Baltimore, Md.
FERRENEWO—Lunkenheimer Co., Cincinnati, Ohio
FERRUBRON—Carbolineum Wood Preserving Co., Milwaukee, Wis.
F. E. S.—Freezing Equipment Sales Inc., York, Pa.
FIBERGLAS—Owens-Corning Fiberglas Corp., Toledo, Ohio
FIRE-BAN—E. H. O'Neill Floors Co., Cicero, Ill.
FIRE-BAN ERECTION CEMENT— E. H. O'Neill Floors Co., Cicero, Ill.
FLAKICE—Flakice Corp., Brooklyn, N. Y.
FLEXAZONE—Drayer-Hanson Inc., Los Angeles, Calif.
FLEXON—Flexonics Corp., Maywood, Ill.
FLO—Allin Mfg. Co., Chicago, Ill.
FLORITE—Bacharach Industrial Instrument Co., Pittsburgh, Penna.
FLOW-COLD—Acme Industries Inc., Jackson, Mich.
FLOW-MASTER—Sporlan Valve Co., St. Louis, Mo.
FLOW-MIZER—Acme Industries, Jackson, Mich.
FLOW-PAK—Acme Industries Inc., Jackson, Mich.
FLOW-TEMP—Acme Industries, Jackson, Mich.
FLOW-THERM—Acme Industries, Jackson, Mich.
FOAMGLAS—Pittsburgh Corning Corp., Pittsburgh, Pa.
"FREON"—Kinetic Chemicals Div., E. I. duPont de Nemours & Co., Wilmington, Del.
FREZALL DRY ICE—Spencer Chemical Co., Kansas City, Mo.
FREZE-CEL—Dole Refrigerating Co., Chicago, Ill.
FRICK—Frick Company, Waynesboro, Pa.
FRIGIDCOAT—Willer & Williams Co., Brighton, Boston, Mass.
FROSTLINE—American Machine & Metals Inc., Sellersville, Pa.
FROSTOP—Jamieson Cold Storage Door Co., Hagerstown, Md.
FROST'S COUPLINGS—Koppers Co. Inc., Pittsburgh, Pa.
FULLER—Freezing Equipment Sales Inc., York, Pa.
FULL-GRIP—Masury Mfg. Corp., Chicago, Ill.
FULL-VISION—Acme Protection Equipment Co., South Haven, Mich.
FUSETRON—Bussmann Mfg. Co., St. Louis, Mo.
FUSTAT—Bussmann Mfg. Co., St. Louis, Mo.

G

GALVICON—Galvicon Corp., Chemical Div., New York, N. Y.
GAYVAC—Gay Engineering Corp., Los Angeles, Calif.
GEBHARDT'S—Advanced Engineering Corp., Milwaukee, Wis.
GEMCO—Goodloe E. Moore, Inc., Danville, Ill.
GENETRON—General Chemical Div., Allied Chemical & Dye Corp., New York, N. Y.
GLASFLEECE—The Carney Co. Inc., Mankato, Minn.
GLUCOSATES—D. H. Haering & Co. Inc., San Antonio, Tex.
GM DETROIT DIESEL ENGINES—Detroit Diesel Eng. Div. of General Motors Corp., Detroit, Mich.
GOODFELLOW COOLING TOWERS—E. D. Goodfellow Co. Inc., Memphis, Tenn.
GOOD PUMPS—E. D. Goodfellow Co. Inc., Memphis, Tenn.
GOULDS—Goulds Pumps Inc., Seneca Falls, N. Y.
GRINNELL—Grinnell Company, Providence, R. I.
GUSHER—Rathman Machinery Co., Cincinnati, Ohio

H

HACCO—Hawkins Chemical Co., Los Angeles, Calif.
HAIRINSUL—American Hair & Felt Co., Chicago, Ill.
HALLETT—Hallett Mfg. Co., Inglewood, Calif.
HALL IDEAL—Hall Machine Shop, New Smyrna Beach, Fla.
HASKO-STRUCT—Haskelite Mfg. Corp., Grand Rapids, Mich.
HAVENS—Havens Structural Steel Co., Kansas City, Mo.
HEAT-CEL—Dole Refrigerating Co., Chicago, Ill.
HERCULES—Hercules Motors Corp., Canton, Ohio
HERMAN NELSON—American Air Filter Co., Louisville, Ky.
HEV-E-OIL—Cleaver Brooks Co., Milwaukee, Wis.
HEVI-LIFT—Hamilsfeger Corp., Milwaukee, Wis.
H H SERIES—Drayer-Hanson Inc., Los Angeles, Calif.
HHV SERIES—Drayer-Hanson, Inc., Los Angeles, Calif.
HI-CAP—Bussmann Mfg. Co., St. Louis, Mo.
HI-G-CONTROLS—General Controls Co., Glendale, Calif.
HI-PEAK—Acme Industries Inc., Jackson, Mich.
HOFFCO VAC—United States Hoffman Corp., New York, N. Y.
H-O-H PROPORTIONING FEELERS—D. W. Haering & Co. Inc., San Antonio, Texas
HOUGHTON-CLEAN—E. F. Houghton & Co., Philadelphia, Pa.
HOWE—Howe Ice Machine Co., Chicago, Ill.
HUBBELL—Hubbell Corp., Mendelein, Ill.
HYDRAMOTOR VALVES—General Controls Co., Glendale, Calif.
HYDROPEL—American Bitumuls & Asphalt Co., San Francisco, Calif.

I

ICE-A-TERIA—Perfection Ice Scoring Machine Co., Fort Worth, Texas
ICE-CEL—Dole Refrigerating Co., Chicago, Ill.
ICIZER—Lilly Co., Memphis, Tenn.
ILLINOIS ENGINEERING—American Air Filter Co., Louisville, Ky.
IMECO—Industrial Mfg. & Engineering Co., Chicago, Ill.
IMMERSATHERM—Mercoid Corp., Chicago, Ill.
IN-HIB-CO.—D. W. Haering & Co. Inc., San Antonio, Tex.
INSULAG—Quigley Co. Inc., New York, N. Y.
INSULMAT—J. W. Mortell Co., Kankakee, Ill.
IPECO—Ice Plant Equipment Co. Inc., Philadelphia, Pa.
ISOFLEX "B"—Isoflex Corp., San Francisco, Cal.
ISOFLEX-K 20—Isoflex Corp., San Francisco, Cal.
ISOTRON—Pennsylvania Salt Mfg. Co., Philadelphia, Pa.

J

JAMISON—Jamison Cold Storage Door Co., Hagerstown, Md.
J-E—Jackes-Evans Mfg. Co., St. Louis, Mo.
JARENE—Jarrow Products Inc., Chicago, Ill.
JARROW—Jarrow Products Inc., Chicago, Ill.
J-B-T—J-B-T Instruments, Inc., New Haven, Conn.
JOHN CRANE—Crane Packing Co., Chicago, Ill.
JOINTITE—Mundet Cork Corp., North Bergen, N. J.
JOINT SEAL NO. 411—Armite Laboratories, Los Angeles, Cal.
JUSTRITE—Justrite Mfg. Co., Chicago, Ill.

K

K B UNIT—Trane Co., La Crosse, Wis.
KING CLIP—Lunkenheimer Co., Cincinnati, Ohio
KING KOLDWALL VESTIBULES—King Co., Owatonna, Minn.
KING SHARP FREEZE SYSTEMS—King Co., Owatonna, Minn.
KING ZEERO—King-Zeero Co., Chicago, Ill.
KNO-DRAFT—Connor Engineering Corp., Danbury, Conn.
KOHLECO—Kohlenberger Engineering Co., Fullerton, Calif.
KOHLENBERGER—Kohlenberger Engineering Co., Fullerton, Calif.
KOLDBOARD—Baldwin-Hill Co., Trenton, N. J.
KOLD-HARD—Tranter Mfg. Inc., Lansing, Mich.
KRACK—Refrigeration Appliances Inc., Chicago, Ill.
KRUPP—Cyrus Shank Co., Chicago, Ill.
KUBEKING—LaCrosse Cooler Co., LaCrosse, Wis.
KULENE—American Potash & Chemicals Corp., Los Angeles, Calif.

L

LA-CO FLUXES—Lake Chemical Co., Chicago, Ill.
LACROSSE—LaCrosse Cooler Co., LaCrosse, Wis.
LANCASTER—Lancaster Pump & Mfg. Co., Lancaster, Pa.
LAPLESS-ENDLESS—Tex Tex Corp., Grand Rapids, Mich.
LAYKOLD—American Bitumuls & Asphalt Co., San Francisco, Calif.
LAYNE—Layne & Bowler, Memphis, Tenn.
LECTRO-LEVEL—Alco Valve Co., St. Louis, Mo.
LED-PLATE—Armite Laboratories, Los Angeles, Calif.
LEVEL-EYE—H. A. Phillips & Co., Chicago, Ill.
LEVEL-MASTER—Sporlan Valve Co., St. Louis, Mo.
LEVEL-TROL—Fisher Governor Co., Marshalltown, Iowa.
LEWIS (Pumps)—Chas. S. Lewis & Co. Inc., St. Louis, Mo.
LINK-BELT—Link-Belt Co., Chicago, Ill.
LIPMAN ICE BOY—Lipman Div., Yates American Machine Co., Beloit, Wis.
LIQUID EYE—Allin Mfg. Co., Chicago, Ill.
LITTLE GIANT—Samuel S. Gelber Co., Chicago, Ill.
LO-LINE (Cooling Tower)—J. F. Pritchard & Co. of California, Kansas City, Mo.
LOTEMP—Industrial Mfg. & Engineering Co., Chicago, Ill.
LO-TEMP—Jamison Cold Storage Door Co., Hagerstown, Md.
LO-TEMP EVAPORATORS—Mojonnier Bros. Co., Chicago, Ill.
LR—Cleaver Brooks Co., Milwaukee, Wis.

M

MAGNA-FLOW—United States Hoffman Corp., New York, N. Y.
MARLO—Marlo Coil Co., St. Louis, Mo.
MASONEILAN—Mason-Neilan Regulator Co., Norwood, Mass.
MASTER-LINE—Lewis-Shepard Products, Inc., Watertown, Mass.

MAUREYMATIC—Maurey Mfg. Corp., Chicago, Ill.
MAUREY MOR-GRIP V-BELTS—Maurey Mfg. Corp., Chicago, Ill.
MECHANIPAK—Carlock Packing Co., Palmyra, N. Y.
MERCOID—Mercoid Corp., Chicago, Ill.
MERCONTROL—Mercoid Corp., Chicago, Ill.
MERIAM—Meriam Instrument Co., Cleveland, Ohio
MICO—Mahoney Importing Co., Los Angeles, Calif.
MICROMAX—Leeds and Northrup Co., Philadelphia.
MICROMET—Calgon, Inc., Pittsburgh, Pa.
MICROVAC—F. J. Stokes Machine Co., Philadelphia, Pa.
MINI-LINE—Bailey Meter Co., Cleveland, Ohio
MO-SIL-AC—Star-Kimble Motor Div., Mimbis Printing Press & Mfg. Co., Bloomfield, N. J.
MOGUL—North American Magnet Products Co., Cleveland, Ohio
MONO-BLOCK—Baldwin-Hill Co., Trenton, N. J.
MONOGRAM LINE—Refrigerating Specialties Co., Chicago, Ill.
MONOKOVER—Baldwin-Hill Co., Trenton, N. J.
MOR-GRIP—Maurey Mfg. Corp., Chicago, Ill.
MORLEX—Linde Air Products Co., New York, N. Y.
MORTEX—J. W. Mortell Co., Kankakee, Ill.
MORTITE—J. W. Mortell Co., Kankakee, Ill.
MULTI-DUTY—Gates Rubber Co., Denver, Colo.
MYSTIK—Mystik Adhesive Products, Chicago, Ill.

N

NASH—Nash Engineering Co., So. Norwalk, Conn.
NATIONAL ANHYDROUS AMMONIA—Barnes & Page Inc., Kansas City, Mo.
NEOCOAT—Pennsylvania Salt Mfg. Co., Philadelphia, Pa.
NEVER-RIP—Canvas Fabricators Inc., Chicago, Ill.
NICLOY—Babcock & Wilcox Co., Beaver Falls, Pa.
N-M-D—Lunkenheimer Co., Cincinnati, Ohio
NO DRIP—J. W. Mortell Co., Kankakee, Ill.
NO-OX-ID—Dearborn Chemical Co., Chicago, Ill.
NOR-LAKE—Nor-Lake Inc., Hudson, Wis.
NOVOID—National Cork Co., Englewood, N. J.
NOYO—Union Lumber Co., San Francisco, Calif.

O

OAKITE—Oakite Products Inc., New York, N. Y.
OHIO SPECIAL—Ohio Galvanizing and Mfg. Co., Niles, Ohio
OIL-EX—Tex-Tex Corp., Grand Rapids, Mich.
OILOUT—Niagara Blower Co., New York, N. Y.
ONAZOTE—Tiderider Inc., Freeport, N. Y.
OYLTITE-STIK—Lake Chemical Co., Chicago, Ill.
OZITE—American Hair & Felt Co., Chicago, Ill.

P

PACKERS FACTOCRETE—E. H. O'Neill Floors Co., Cicero, Ill.
PALCONATE—Pacific Lumber Co., San Francisco, Calif.
PALCOTAN—Pacific Lumber Co., San Francisco, Calif.
PALCO WOOL—Pacific Lumber Co., San Francisco, Calif.
PALITON—Palton Inc., New York, N. Y.
PANDUX—Pacific Transducer Corp., Los Angeles, Calif.
PARAGON—Paragon Electric Co., Two Rivers, Wis.
PAYNE—Carrier Corp., Syracuse, N. Y.
P C GLASS BLOCKS—Pittsburgh Corning Corp., Pittsburgh, Pa.
PEAK-TEMP—Cleaver Brooks Co., Milwaukee, Wis.
PEERLESS AQUA SAVER—United Cooling Towers Inc., Little Rock, Ark.
PENNPAINT—Pennsylvania Salt Mfg. Co., Philadelphia, Pa.
PERFECTION—Perfection Ice Scoring Machine Co., Fort Worth, Texas
PERMA-FAN—Dreyer-Hansen, Inc., Los Angeles, Calif.
PERMAMIX—Permanix Corp., Chicago, Ill.
P-H HOISTS—Harnischfeger Corp., Milwaukee, Wis.
PHILLIPS—H. A. Phillips & Co., Chicago, Ill.
PIPETTE-STIK—Lake Chemical Co., Chicago, Ill.
PLANT AIR MASK—Acme Protection Equipment Co., South Haven, Mich.
PLASTICOOL—Cooling Laboratories, Inc., Tulsa, Okla.
POLAR—Refrigeration Engineering Co., Minneapolis, Minn.
POMONA—Fairbanks Morse & Co., Chicago, Ill.
PRESO AIR MASK—Acme Protection Equipment Co., South Haven, Mich.
PRESSURIZER—J. E. Watkins Co., Maywood, Ill.
PREST-O-MATIC—Clark Door Co. Inc., Newark, N. J.
PROP-R TEMP—Typhoon Air Conditioning Co., Brooklyn, N. Y.
PROTECTAVALVE—Acme Protection Equipment Co., South Haven, Mich.
PUR AIR—Barnaby-Cheney Co., Columbus, Ohio
PUR-O-WELD MASK—Acme Protection Equipment Co., South Haven, Mich.
PUR-O-TEX—Tex Tex Corp., Grand Rapids, Mich.
PYRATHERM—Mercoid Corp., Chicago, Ill.
PYROTRON—Bailey Meter Co., Cleveland, Ohio

Q

QUICKSEAL—Dave Refrigerating Co., Chicago, Ill.

R

RAM—Robbins & Myers Inc., Springfield, Ohio
RADIAL—Kramer Trenton Co., Trenton, N. J.
READY-POWER—Ready Power Co., Detroit, Mich.
RECIRCULATOR—J. E. Watkins Co., Maywood, Ill.
REDCO—Reynolds Electric Co., River Grove, Ill.
REFOLD—Refrigeration Engineering, Inc., Los Angeles, Calif.
REGOV—Regoy Products Co., Canton, Ohio
RED DIAMOND—Jacket-Brass Mfg. Co., St. Louis.
REGALV—Totemetals, San Francisco, Calif.
RELIANCE—Reliance Electric & Engineering Co., Cleveland, Ohio
REMPE COILS—Rempe Co., Chicago, Ill.
RENEWO—Lunkenheimer Co., Cincinnati, Ohio
REX—Rex Engineering & Sales Co., Oklahoma City, Okla.
RHINAMEL—Tropical Paint Co., Cleveland, Ohio
RING-JET—F. J. Stokes Machine Co., Philadelphia, Pa.
R-K—Rangler-Kingsman Mfg. Co., Salem, Mass.
ROOTS—Roots Connersville Blower Div., Dresser Industries, Connersville, Ind.
ROTO—Elliott Co., Roto Div., Newark, N. J.
ROTOJET—Elliott Co., Roto Div., Newark, N. J.
R/S CONTROLS—Refrigerating Specialties Co., Chicago, Ill.
RUBALT—Alfred Hague & Co., Brooklyn, N. Y.
RUBATEX—Great American Industries Inc., Bedford, Va.
RUBBAIR DOOR—Stic-Klip Mfg. Co., Cambridge, Mass.
RUBBER-COAT—Wilbur & Williams Co., Brighton, Boston, Mass.
RUMACO—Ruthman Machinery Co., Cincinnati, Ohio
RUSTICIDE—Stybrite Co., Cleveland, Ohio
RUST VETO—E. F. Houghton & Co., Philadelphia, Pa.

S

SAFETY SEAL PISTON RINGS—Safety Seal Piston Ring Co., Ft. Worth, Texas
S & S—S & S Vending Machine Co., San Jose, Calif.
SCHENECTADY—General Electric Co., Schenectady, N. Y.
SEALMORE—Armite Laboratories, Los Angeles 1, Calif.
SERVICEMAN—Marsh Instrument Co., Skokie, Ill.
SHANK—Cyrus Shank Co., Chicago, Ill.
SHEAR FLEX—Vibration Mountings Inc., Corona, N. Y.
SHOPLIFTER—Economy Engineering Co., Chicago, Ill.
SIL-CLAD—Electric Machinery Mfg. Co., Minneapolis, Minn.
SNOW PLATE—Dean Products Inc., Brooklyn, N. Y.
SOLECTRO—Aqua-Matic Inc., Rockford, Ill.
SOLITE—Aqua-Matic Inc., Rockford, Ill.
SOLO—Aqua-Matic Inc., Rockford, Ill.
SOLOMATIC—Aqua-Matic Inc., Rockford, Ill.
SOLOMITE—Aqua-Matic Inc., Rockford, Ill.
SOLVEX—Chemical Solvent Co., Birmingham, Ala.
SPACEMASTER—Lewis-Shepard Products, Inc., Watertown, Mass.
SPACESAVER—Flex Products Co., Bowyer, Ill.
SPEEDFLEX—Gates Rubber Co., Denver, Colo.
SPEEDOMAX—Leeds and Northrup Co., Philadelphia, Pa.
SPORLAN—Sporlan Valve Co., St. Louis, Mo.
SPOTAIRE—Dreyer-Hansen Inc., Los Angeles, Calif.
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SPRUYT—Agric Machinery Corp., New York, N. Y.
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SUPERIOR—Superior Valve & Fittings Co., Pittsburgh, Pa.
SUPER POWERHOUSE—Baldwin-Hill Co., Trenton, N. J.
SUPERTHERM—American Machine & Metals Inc., Sellersville, Pa.
SUPREME—Franklin P. Miller & Son Inc., East Orange, N. J.
SUREMASTIC—Camp Co. Inc., Chicago, Ill.
SYLPHON—Fulton Sylphon Div., Robertshaw-Fulton Controls, Knoxville, Tenn.
SYNCHROSTAT—Electric Machinery Mfg. Co., Minneapolis, Minn.

T

TACO—Taco Heaters Inc., Providence, R. I.
TANK-O-METER—Uehling Instrument Co., Paterson, N. J.
TAYLOR MADE—Taylor Made Ice Vending Mfg. Co., Espora, Miss.
TEKTOLOG—Fielden Instrument Div., Robertshaw-Fulton Controls Co., Philadelphia, Pa.
TEKTOR—Fielden Instrument Div., Robertshaw-Fulton Controls Co., Philadelphia, Pa.
TELSTOR—Fielden Instrument Div., Robertshaw-Fulton Controls Co., Philadelphia, Pa.
TEMPLETS—Barnes & Page, Inc., Kansas City, Mo.
TEMPRITE—Temprite Products Corp., Birmingham, Mich.
TEMPSCRIBE—Bacharach Industrial Instrument Co., Pittsburgh, Pa.
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TEXACO—Texas Co., New York, N. Y.
T-FLO—Ansul Chemical Co., Marinette, Wis.
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THERMOFREZE—Consolidated Services Inc., Seattle, Wash.
THERMO KING—U. S. Thermo Controls Co., Minneapolis, Minn.
THREAD-TITE—Armite Laboratories, Los Angeles, Calif.
TON-TEX—Tex-Tex Corp., Grand Rapids, Mich.
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TURBINE-TYPE—New York Air Brake Co., Aurora Pump Div., Aurora, Ill.
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UNICON—Kramer Trenton Co., Trenton, N. J.
UNI-CREST—United Cork Companies, Kearny, N. J.
UNI-FLO—Barber-Colman Co., Rockford, Ill.
UNITED'S B B—United Cork Companies, Kearny, N. J.
UNITRANE—Trane Co., LaCrosse, Wis.
U. S. AIR CO.—U. S. Air Conditioning Corp., Philadelphia, Pa.

V

VACUMATIC-48—United States Hoffman Corp., New York, N. Y.
VALVEVOSS—J. H. H. Voss Co. Inc., New York.
VAPO-WALL—Inc., Houston, Texas
VAP-R-TYT—Jamison Cold Storage Door Co., Hagerstown, Md.
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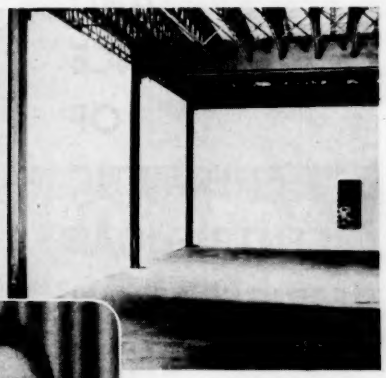

A Fire-Ban coating was applied in white color over "Foamglas."

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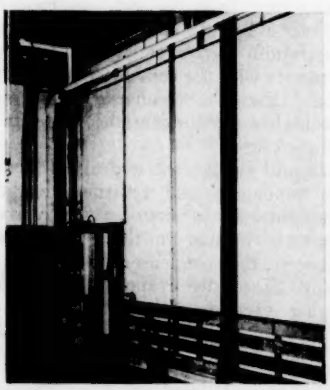

Fire-Ban Finish over "Styrofoam" (a Dow plastic) in the produce and frozen food plant of the Super Valu Stores, Inc. at Hopkins, Minn. Approximately 40,000 sq. ft. area is finished with Fire-Ban. *The same owner has specified and contracted for Fire-Ban Finish on two similar installations at Bismarck, N. D. and Green Bay, Wis., through Insulation Sales Company.*

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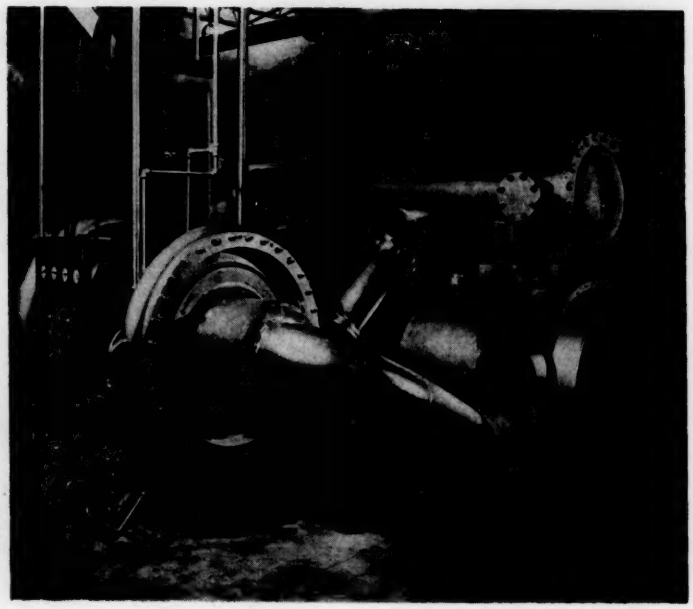
Practical Refrigerating Engineer

NATIONAL ASSOCIATION PRACTICAL REFRIGERATING ENGINEERS

OPERATION AND MAINTENANCE OF HERMETIC CENTRIFUGAL REFRIGERATION UNITS in the – Prevention of REFRIGERATING PLANT FAILURES



LINCOLN R. SCAFE
Manager, Service Department
The Trane Company, LaCrosse, Wis.

PURPOSE of this article is to familiarize the practical engineer with the operation and maintenance of a hermetic centrifugal refrigeration machine. In the article, no attempt will be made to parallel or show differences between operation and maintenance of hermetic centrifugals, as opposed to open type centrifugals. Neither will the article deal with installation or original start-up of this type of unit. It will deal mainly with the centrifugal refrigeration cycle, together with operation and maintenance of its components.

Primarily, centrifugal refrigeration machines are water chillers for air conditioning and process systems. While their chief purpose is to chill water, they can be used to cool many other liquids as well. Fig. 1 illustrates the hermetic centrifugal unit.

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Hermetic Refrigeration Cycle

In the hermetic refrigeration cycle, as in all refrigeration systems, the three basic functional parts — compressor, evaporator, and condenser — are incorporated into the refrigeration cycle (see Fig. 2). Water to be cooled flows through the evaporator tubes transferring heat from the water to the refrigerant. In taking on this heat, the liquid refrigerant boils, changing to a gaseous state. The temperature at which the refrigerant boils depends upon the vacuum being maintained in the evaporator. The greater the vacuum in inches, as read on the evaporator pressure gage, the lower the boiling temperature. Gas from the evaporator passes upward through the eliminator, which removes any small drops of entrained liquid refrigerant, and then into the compressor. Here the gas is compressed by means of centrifugal force to the condensing conditions.

Two stages of compression are used in series. Gas from the first stage is discharged into the second stage, and gas from the second stage is discharged into the condenser. The relatively cool water in the tubes extracts heat from the gas, condensing it into a liquid. The temperature of the liquid refrigerant varies in accordance with the condenser pressure. The higher the condenser pressure, the higher the condensed liquid temperature.

Liquid refrigerant is drained from the condenser and returned to the evaporator by means of a float valve assembly located in the liquid line between the condenser and evaporator. Since the evaporator is at a higher vacuum and lower temperature than the condenser, the liquid refrigerant cools itself to the existing evaporator temperature by flashing. The flash gas passes up through the liquid refrigerant in the evaporator and then to the compressor inlet. The remainder of the liquid is evaporated,

cooling the water in the evaporator tubes, thereby completing the cycle.

While there are many parts or components in the complete centrifugal unit, these can generally be grouped as follows: hermetic compressor, lubricating system, condenser, evaporator, instrument panel, purge unit, and temperature actuated pneumatic control system.

Two-Stage Compressor

The hermetic centrifugal compressor consists of a motor, first and second stage volutes, suction covers, pre-rotation vane assemblies, impellers, and water-cooled motor jacket. In larger sizes the motor jacket is gas-cooled, utilizing refrigerant from the system as the cooling medium. Fig. 3 shows a cross section of this compressor. The hermetic motor operates at a constant speed of approximately 3600 rpm. In units using water as the cooling medium in the motor jacket, drain plugs are provided so that the jacket can be drained in the event the unit is installed in a location where freezing temperatures may be encountered.

The rotor assembly and the two compressor impellers are supported by sleeve bearings. These two main bearings are the only bearings within the compressor unit. Oil is supplied under pressure to these bearings through oil supply lines from the lubricating system. The bearings are protected by an oil failure switch located in the control panel. This switch prevents operation of the compressor motor whenever oil pressure is below a safe minimum.

The volutes are mounted on either end of the motor frame. First and second stage impellers are mounted at either end on the extended motor shaft. A suction cover provided with a flange is mounted on the volute casing and serves to complete the enclosure for the impeller. A sight glass is provided on one of the suction covers to determine the direction of rotation of the motor.

In the compressor assembly located just ahead of the suction inlet to the first and second stages, are vane housings which contain pre-rotation vane mechanisms to modulate the flow of refrigerant to the impellers.

Lubrication System

As mentioned, the hermetic motor is equipped with two sleeve bearings which are mounted within the compressor and are the only points in the hermetic motor requiring lubrication. The bearings are lubricated by an electrically driven hermetically sealed positive displacement oil pump located in the oil sump. The oil sump is mounted in the frame which supports the compressor motor. The lubrication cycle is shown in Fig. 4.

Oil return lines from the motor flanges connect to fittings on the rear plate of the oil sump. A vent line equalizes the pressure between the oil tank and the motor housing to provide gravity return of oil from the motor to the sump. The oil pump is located below the operating oil level in the sump to provide an adequate supply of oil to the oil pump suction inlet. Oil pressure supplied to the bearings by the oil pump is regulated by a relief valve which is located on the front cover of the oil sump.

An oil pressure gage, oil temperature control, and differential oil pressure control are located in the CenTraVac instrument panel. The well for the remote sensing bulb of the oil temperature controller is mounted in the rear wall of the oil sump. A two-stage heating and cooling thermostat maintains the lubricating oil at the proper temperature by either energizing an electric heater in the oil sump to warm the oil, or by opening a solenoid valve in the water line to supply cooling water to the oil cooling coil.

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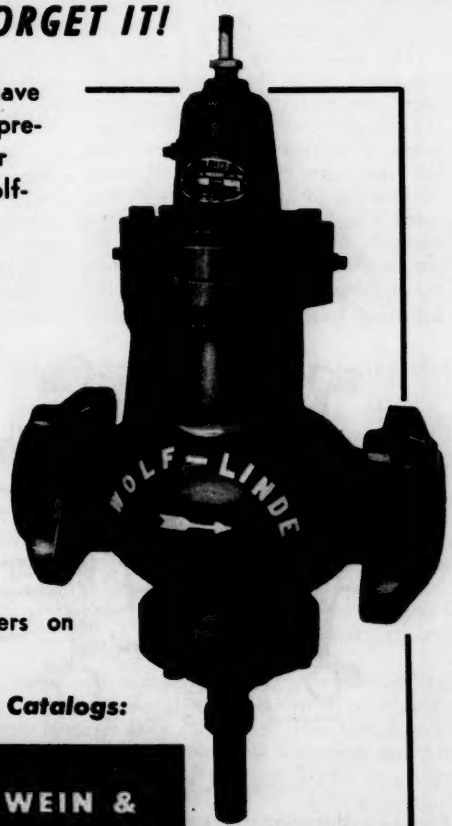

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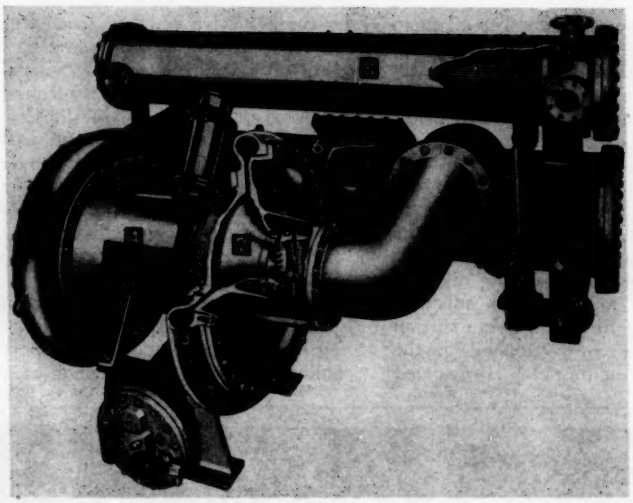


Fig. 1 — Principal components of the Trane Co., Centravac water or process fluid chilling unit: 1 — vane control, regulates gas flow to each impeller; 2 — impeller; 3 — volute housing, for conversion of velocity energy to static pressure; 4 — motor, hermetically sealed to prevent refrigerant loss; 5 — lubrication system, force-feed; 6 — evaporator; 7 — float valve, meters liquid flow from condenser to evaporator; and 8 — condenser.

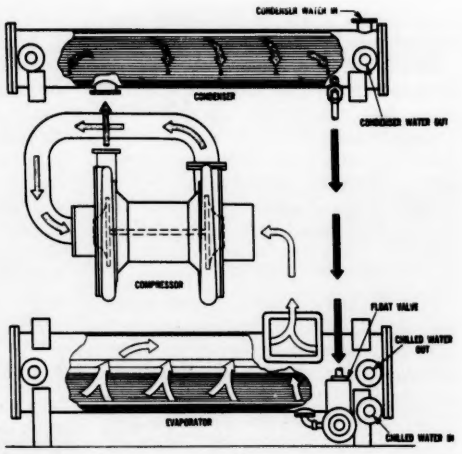


Fig. 2 — Typical refrigerant cycle in the centrifugal compression system.

Two sight glasses are provided on the front cover of the oil sump to check the oil level and to determine the direction of rotation of the oil pump. A thermometer is installed on the front cover plate of the oil sump to indicate the oil temperature. Located on the left side of the front cover is an oil filter through which passes all of the oil going to the motor bearings. Also located in the lubricating system is a pressure relief valve which functions to regulate the pressure of oil supplied.

Condenser Details

To provide efficient distribution of the gas within the condenser, a perforated plate is located directly in front of the discharge inlet connection. The perforated plate distributes refrigerant gas through the entire length of the condenser. A liquid sump at the bottom of the shell causes the condensed refrigerant to drain away from the tubes. A slight pitch in the condenser assists the flow of liquid refrigerant to this sump. Since a portion of the hermetic centrifugal system operates under a vacuum, a small amount of air and water vapor may enter the system. A baffle is installed in the condenser at the end near the liquid sump to trap noncondensible gases at this point. It is to this end of the condenser that connections are made to the purge unit. See Fig. 5.

Removable covers on the water boxes provide access to the condenser tubes for checking and cleaning purposes. The water boxes and covers are so arranged that the covers may be removed without disconnecting the water piping.

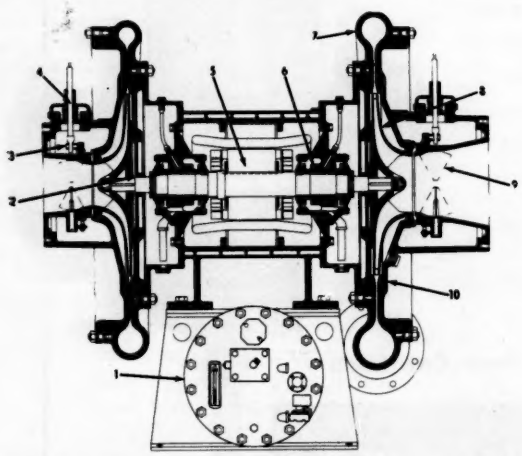


Fig. 3 — More important parts of the Trane hermetic centrifugal compressor: 1 — base and oil tank assembly; 2 — labyrinth seals; 3 — actuator ring and ball joint linkage; 4 — external vane control linkage with bellows seals; 5 — water cooled motor; 6 — pressure lubricated sleeve bearing; 7 — volute casing; 8 — impeller; 9 — variable inlet guide vanes; 10 — suction cover.

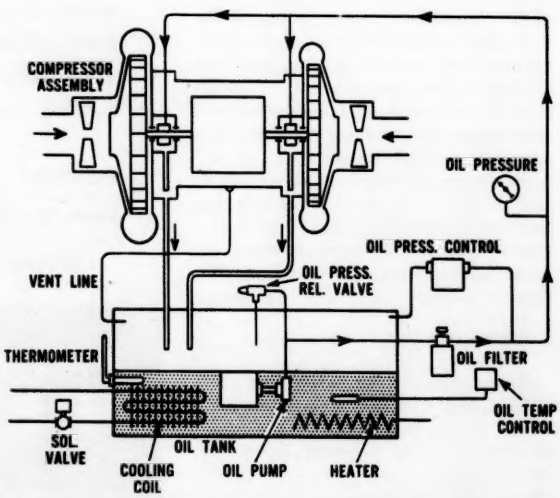
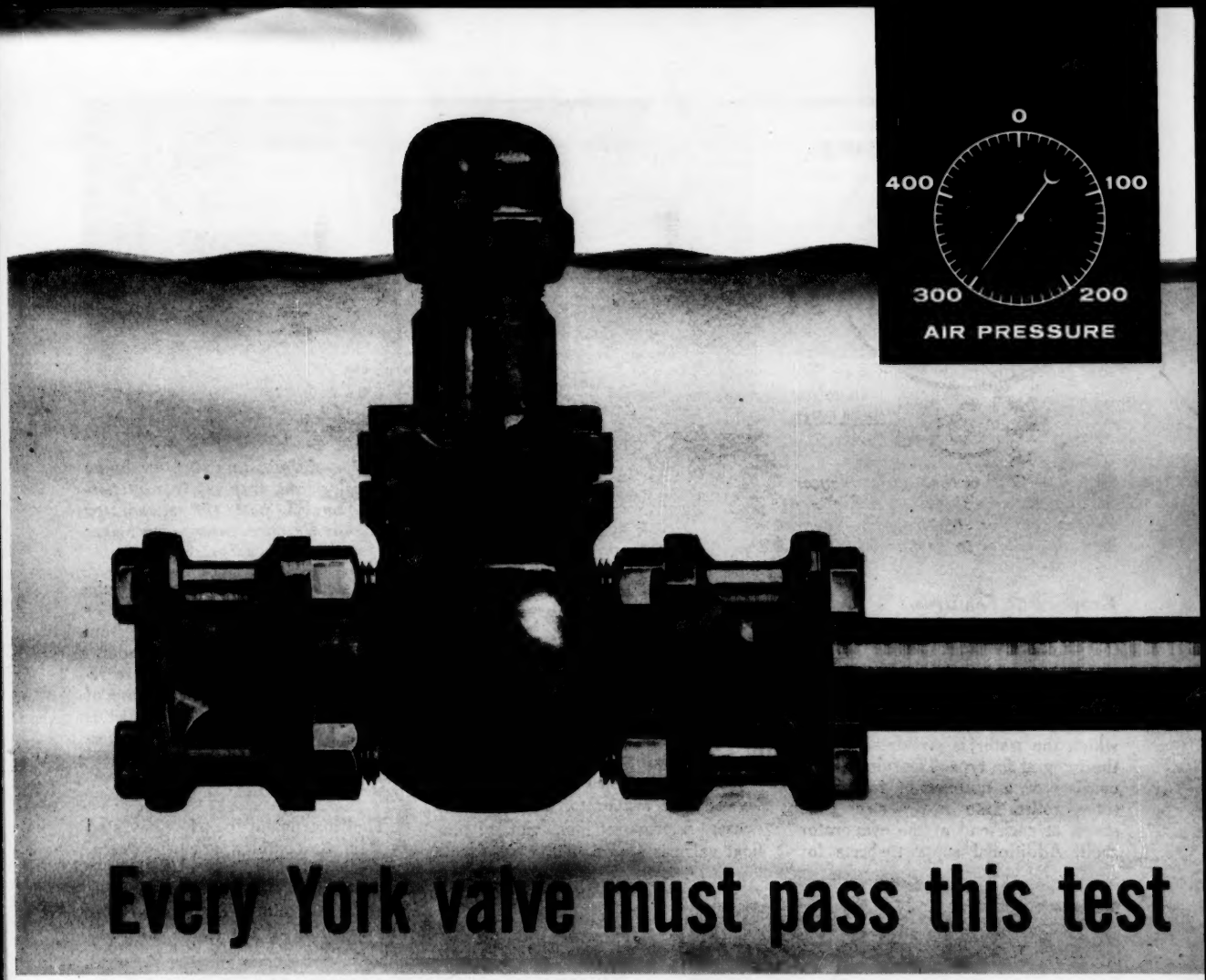


Fig. 4 — Lubrication system involves both heating and cooling elements for close control of oil temperature.



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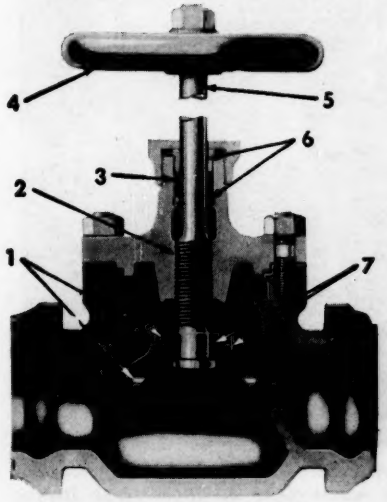

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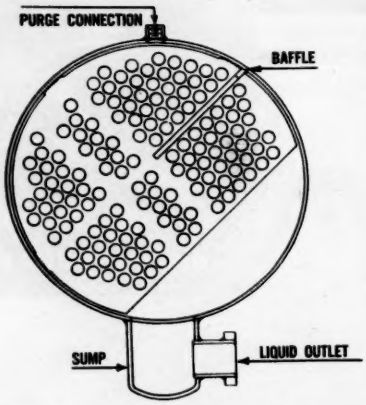

Fig. 5 — Section through condenser at sump end, showing baffle arrangement for trapping non-condensibles to be purged.

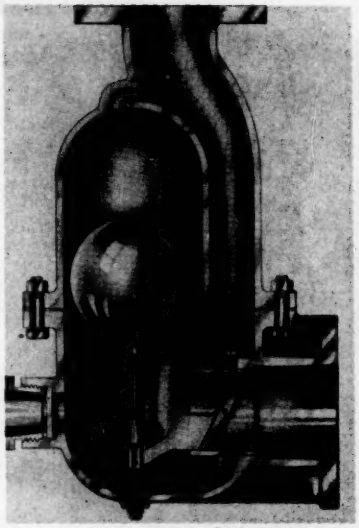

Fig. 6 — Section through liquid float which regulates evaporator refrigerant feed.

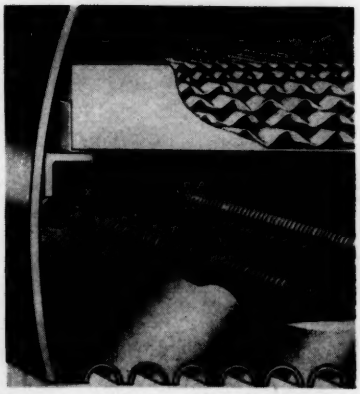

Fig. 7 — Eliminators such as shown in this section, trap refrigerant particles carried past the evaporator tube bundle, preventing carry-over to the compressor.

Evaporator Features

The evaporator is of the semi-flooded shell-and-tube type with water inside the tubes and liquid refrigerant within the shell surrounding the tubes. The copper tubes through which the water is circulated are of the integral fin type. The tube bundle consists of a number of individual tubes rolled into heavy steel tube sheets at each end of the evaporator shell. Additional support sheets for the tube bundles are provided at intermediate points.

Flow of liquid refrigerant to the evaporator is controlled by a float assembly located in the liquid line between the evaporator and the condenser. A cross sectional view of the float valve is shown in Fig. 6.

Located above the evaporator tube bundle are eliminators (see Fig. 7) which prevent liquid refrigerant from being carried over from the evaporator to the compressor. A pressure relief device is mounted on the top of the evaporator shell and an outlet is provided in this device for an atmospheric vent line connection.

Instrument Panel

The instrument panel, illustrated in Fig. 8, contains pressure gages, protective devices, and a load limit control mechanism. It also contains switches and pilot lights necessary for the operation of the purge unit and

Fig. 8 — Typical control panel for this make hermetic centrifugal system. Gauges at top indicate oil, evaporator, condenser, and purge drum pressures. In the open panel box in top row are the two temperature control relays, pneumatic electric switch and gauge, and the load limit relay. Across the bottom are oil pressure and temperature, motor temperature, refrigerant low temperature and condenser high pressure controls. Devices in the hinged cover are push button stations, resets, and indicator lights.

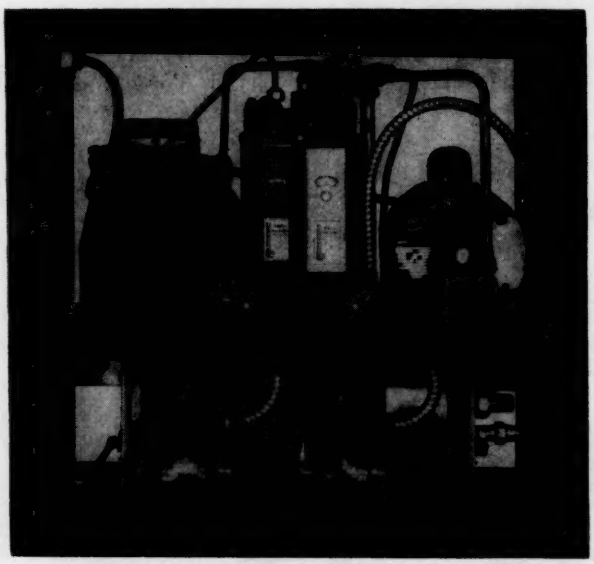

Fig. 9 — Purge unit with covers removed, showing compressor, oil separator, and motor drive at upper level. Below, liquid solenoids for returning refrigerant to evaporator, and for gas connection to condenser, are located in front of the purge drum. Sight glass and blow off valve are visible at lower right.

the lubricating system. The four pressure gages located at the top of the panel indicate oil, evaporator, condenser, and purge drum pressures.

Purge Unit Components

The purge unit is a complete system mounted in a cabinet which is attached to the outside of the chiller unit. With certain portions of the system operating in a vacuum, air and moisture may enter the system. If allowed to accumulate, the air would increase the pressure in the condenser, resulting in increased power input and decreased cooling capacity. The function of the purge system, illustrated in Fig. 9, is to remove air and water vapor from the system. The purge cycle is detailed in Fig. 10.

Purge Functions Described

Air, water vapor, and a small amount of refrigerant is drawn from the condenser by the purge compressor. These noncondensibles are compressed and discharged into an oil separator. While running, the purge compressor will discharge a small amount of oil along with the non-condensible vapor. If some means were not provided for the return of this oil, the compressor would in time lose its oil charge and seize from lack of lubrication. Because of this, an oil separator is provided in the purge system to return oil to the crankcase of the purge compressor.

Built into the oil separator is an automatically operated temperature actuated heater. This heater keeps the oil in the separator warm and prevents condensation of refrigerant in the separator. Air, water vapor, and refrigerant are passed from the oil separator to the purge drum. Once the air, water vapor, and refrigerant enter the purge drum, they are spread by a distributing tube across a water cooling coil. As the air, water vapor, and refrigerant pass over the cooling coil, condensation takes place. Water and refrigerant are thus condensed out of the air.

A mixture of water and liquid refrigerant will separate completely, the lighter water floating above the heavier refrigerant. Within the purge drum is a baffle plate or partition which divides the drum into two sections. This can be seen in Fig. 10. The dam or partition allows only liquid refrigerant to pass into the float section of the purge drum, from which it returns to the evaporator. Flow from the purge drum to the evaporator takes place because the pressure within the drum is greater than that in the evaporator section.

Pressure Relief Valve

Within the purge drum is a pre-set pressure relief valve. As air pressure builds up within the purge drum, it will reach the pre-determined or pre-set point. The relief valve will open automatically and relieve air to the atmosphere. As the pressure lowers, the pressure relief valve will close and will remain closed until such time as the air pressure again builds up within the purge drum. A high-pressure cutout is built into the purge system to stop the operation of the compressor should the pressure relief valve for some reason fail to open.

Temperature Actuated Control System

Temperature controller functions start and stop the hermetic system and modulate capacity to maintain desired water temperature. Many different types of temperature controllers are used. There will be no attempt to discuss here, all types of temperature controllers available. Features included in all types are outlined.

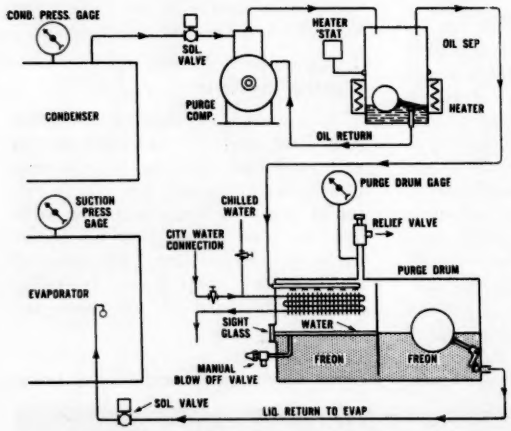

Fig. 10 — Schematic of purge system.

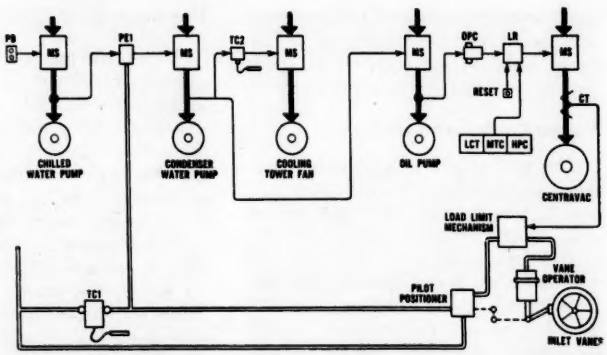

Fig. 11 — Schematic of control sequence showing over-riding safety cutouts: PB — Push Button Station; MS — Magnetic Starter; PEl — Pneumatic Electric Switch; TC2 — Cooling Tower Fan Control; OPC — Oil Pressure Control; LR — Lockout Relay; LTC — Low Temperature Cut-Out; MTC — Motor Temperature Cut-Out; HPC — High Pressure Cut-Out; CT — Current Transformer; TC1 — System Temperature Control.

Control Circuit Interlocks

To provide safe, unattended automatic operation of the hermetic centrifugal refrigeration system, it is essential that certain safety controls be included that will stop the compressor if any of the following conditions exist:

(1.) lack of lubricating oil pressure at the compressor motor bearings.

(2.) low refrigerant temperature.

(3.) high motor temperature.

(4.) high condenser pressure.

To accomplish this protection: (1), a differential oil pressure controller is provided to prevent against loss of oil pressure; (2), a low temperature cutout measures liquid refrigerant temperature in the evaporator and protects against freeze-ups; (3), a motor temperature cutout with a sensing bulb in the compressor motor water jacket prevents operation should the motor temperature become excessive; and (4), a high pressure cutout measures condensing pressure and provides high pressure protection.

The low temperature cutout, motor temperature cutout, and the high pressure cutout are all connected into the circuit of a manually reset lock out relay. Dangerously low temperature, high motor temperature, or excessive head pressure will cut off the compressor and lock it out until the relay is reset by means of a push button. This arrangement is intended to bring the operator on the scene to ascertain the fault before restarting.

In order to provide fully automatic operation of the centrifugal system, the various auxiliary devices, such as the pumps and the cooling tower fan, should also be automatic in their operation. To accomplish this, interlocking between the various devices is necessary. Fig. 11 shows in block diagram form the complete typical control set-up for a single machine.

Control Sequence Described

In order that the thermostat TC1, which is the controlling element, may measure the chilled water temperature, it is necessary that the chilled water be circulated at all times whether the centrifugal system is in operation or not. Therefore, the chilled water pump is controlled manually be means of a push button and all of the remaining control functions are dependent upon its operation.

The pressure or PE switch controls the operation of the condenser water pump and whenever the chilled water temperature rises to a point where refrigeration is required, the condenser pump is started. Interlocked with its starter is a magnetic starter for the lubricating oil pump. This device starts the lubricating oil pump as soon as the condenser water pump is in operation.

Starting of the lubricating oil pump causes the oil pressure supply to the bearings of the compressor to build up, and when this pressure has reached the set value, the differential oil pressure switch closes its contacts, permitting the starter on the compressor motor to operate.

Interposed in the circuit between the differential oil pressure switch and the compressor starter is the lock out relay. This device, which is manually set by the reset button, is dropped out by any of the safety devices and has its contacts closed only as long as the refrigerant temperature is normal, the motor is not overheated, and the condenser pressure is normal, thus permitting the compressor motor to start.

Tower Fan Interlocked

With the starting of the condenser water pump, a circuit is provided to the thermostat TC2 which has its sensing element located in the cooled condenser water. When the temperature at this point exceeds its setting, it allows the magnetic starter controlling the cooling tower fan to operate.

The operation of the complete system may be summed up as follows: The chilled water pump is started manually and is run as long as refrigeration is apt to be required. The PE switch actuated by the air pressure from the chilled water thermostat starts the condenser water pump, which in turn starts the lubricating oil pump which, through the differential oil pressure switch and the lock out relay governed by the protective devices, starts the compressor motor. The cooling tower fan is permitted to run under the control of a condenser water thermostat as long as the condenser water pump is in operation. When cooling is no longer required, the PE switch cuts off the condenser water pump, thus interrupting the chain of control and stopping the compressor motor.

When the centrifugal refrigeration machine is in operation, its inlet vanes are under control of the chilled water thermostat as long as the temperature conditions are normal. Under abnormally high chilled water temperature or a high condensing water temperature, any tendency toward overloading is prevented by the action of a load limit mechanism

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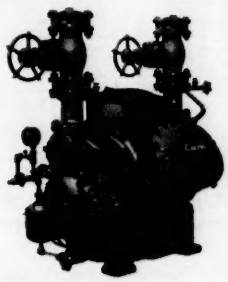

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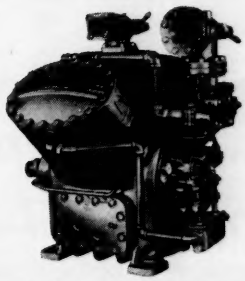

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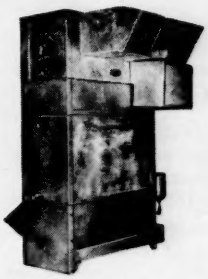

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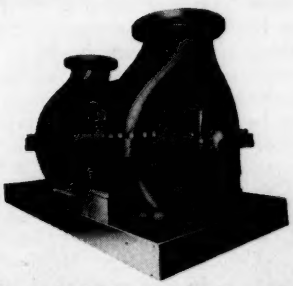

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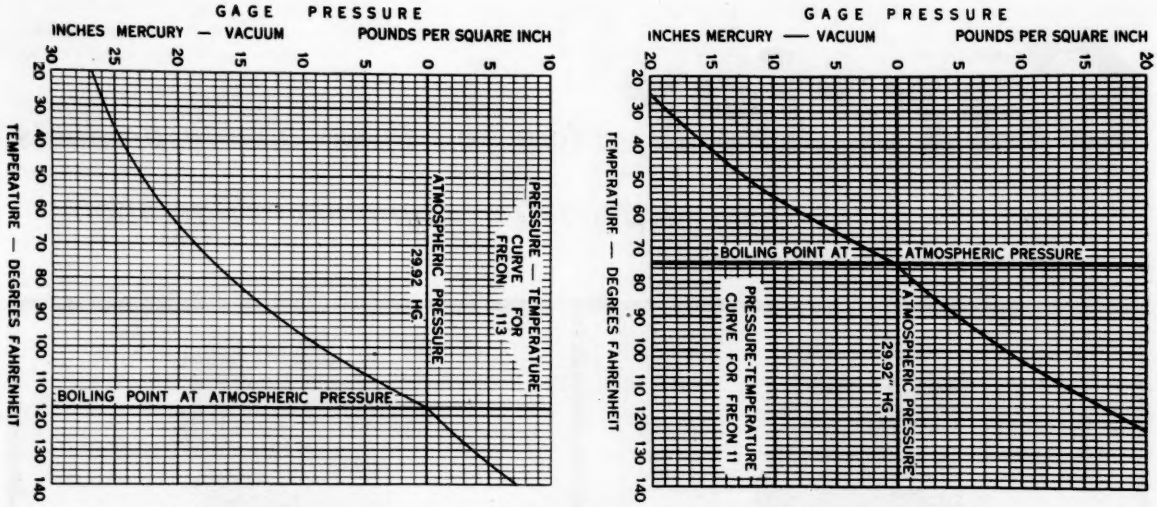
GAGE PRESSURE
INCHES MERCURY — VACUUM
POUNDS PER SQUARE INCH
TEMPERATURE — DEGREES FAHRENHEIT
BOILING POINT AT ATMOSPHERIC PRESSURE
ATMOSPHERIC PRESSURE 29.92 HG.
PRESSURE — TEMPERATURE CURVE FOR FREON 113
GAGE PRESSURE
INCHES MERCURY — VACUUM
POUNDS PER SQUARE INCH
TEMPERATURE — DEGREES FAHRENHEIT
BOILING POINT AT ATMOSPHERIC PRESSURE
ATMOSPHERIC PRESSURE 29.92" HG.
PRESSURE-TEMPERATURE CURVE FOR FREON 11

Fig. 12 — Comparison of pressure-temperature relationships between Refrigerant-11 and Refrigerant-113. Either are used in the hermetic type centrifugal system. Refrigerant-113 is represented at left.

which limits the opening of the inlet vanes to a point above which overloading might occur.

The foregoing description of the control cycle has omitted mention of the actual electrical circuits involved and the precise method of interlocking the various components of the system since these circuits vary considerably.

Refrigerants Used With Hermetic Centrifugals

Hermetic centrifugals use one of two fluorinated hydrocarbon refrigerants — trichlorotrifluoromethane, known as "Freon-113" and "Genetron-226", or trichloromonofluoroethane, known as "Freon-11" and "Genetron-11."

Refrigerant-113[1] is a stable water clear liquid at atmospheric pressure, where it boils at 117.6 F. Because of its relatively high boiling point, it can be stored safely in steel drums and handled freely without difficulty when charging the unit. The refrigerant is nontoxic, nonflammable, and has a slightly sweet odor.

Refrigerant-11[2] is similar to Refrigerant-113 in physical characteristics, but boils at 74.7 F in atmospheric pressure. Fig. 12 illustrates the curves which give the boiling temperature of both refrigerants at all pressures over the normal operating range.

Operating the Unit

In operating and maintaining a hermetic centrifugal refrigeration system, the importance of understanding the refrigeration cycle and knowing how to use the pressure temperature relationship charts together with the gages cannot be overemphasized. If the operator knows what the pressures and temperatures reported by the gages and thermometers mean, then readings taken or observed will be of real value to him. During operation, pressure and temperature readings taken indicate to the skilled operator many important points affecting efficiency and performance of the unit.

First indications of trouble can usually be detected by pressure and temperature readings. However, if the trouble is not detected and corrected when it begins to show up, it will, if allowed to continue, always show up in a control device whether it be an operating control or a safety control. When trouble does occur and the unit cuts out on one of its controls, first attention should be given to the control device.

It is elementary that in all cases the control setting and function be checked to see that there is nothing wrong before a thorough investigation is made. Once the control device has been checked and found to be functioning properly and at its correct set point, then pressure and temperature readings become all important.

Trouble Diagnosis

Examine some troubles that can occur. From these examples it can be readily demonstrated just how important gage readings can be. Trouble can be detected quickly by a good knowledge of pressure — temperature relationship.

Complaint: Unit cuts out on high head pressure.

Since portions of the hermetic centrifugal refrigeration unit operate under a vacuum, it is possible that air, which is noncondensible gas, has been drawn into the system. It could be the cause of high head pressure. Therefore, it is necessary to determine whether or not air has been drawn into the machine. Air trouble can easily be pinpointed by taking a reading of the condenser gage and at the same time reading the temperature of the liquid refrigerant in the condenser sump. In working out these readings, it will be necessary to refer to a pressure-temperature relationship chart, such as those shown in Fig. 12.

Assume that the unit being checked is charged with Refrigerant-113. With the machine in operation, a reading from the condenser pressure gage is taken. That reading is 2 in. of vacuum and the temperature of the liquid refrigerant in the condenser sump is 96 F. By referring to the pressure-temperature relationship chart, it can be found that the head pressure is too high for the leaving liquid temperature. At a 96 F leaving temperature the head pressure should be 10 in. of vacuum, not considering any sub-cooling. But, the head pressure could run as high as 8 in. of vacuum and probably have no appreciable amount of air in the system. However, with a difference as great as 10 to 2 in., there is air in the system.

Locate Trouble Cause

After it has been determined that there is an accumulation of air in the system, two more things should

[1]Generic term now applied to trichlorotrifluoromethane (CCl_3F)

[2]Generic term now applied to trichloromonofluoroethane ($C_2Cl_3F_3$)

be investigated. First, why isn't the purge unit taking care of air which has entered the system? Second, where is the air getting into the system? It may be that the purge unit is not operating efficiently, or perhaps the purge unit has been shut off manually and not run for sufficient periods of time during the operation of the entire system.

If it is found that the purge system has been run regularly, all valves in the purge system should be checked to see that they are open. Running the purge system with the valves closed would have as little effect as not operating the purge system at all. If the purge system has been run with all valves open, and has not taken care of air in the system, it may mean one of two things — either the purge system has become inefficient due to the lack of proper maintenance, or the air in-leakage is greater than the purge system can handle and remove. In any event, the leak should be detected and repaired.

Further Diagnosis

Continue checking on the same complaint that the unit has cut out on high head pressure: It is entirely possible that air may not be the cause of the unit cutting out on the high head pressure. The other main category in this type of trouble would be in the condenser water supply. Usually troubles involving the condenser can be broken down into four groups:

(1.) Air in the condenser water circuit
(2.) Bad water or lack of water
(3.) No water treatment
(4.) Too much water treatment

For the sake of discussion, assume that the system involves a cooling tower which is the most common condenser water cooling arrangement found on these centrifugal systems. With condenser water supply trouble, the condenser water temperature-rise will be low; that is, if the system was designed originally for a 10-degree temperature rise, it will probably be found that the temperature rise is only 6 or 7 degrees and the condensing temperature will be higher than normal. The result, of course, is an abnormal temperature difference between the condensed refrigerant and the leaving condenser water. The liquid temperature in the condenser sump will also be high; however, that is assuming there is no appreciable air in the unit.

At this point in the checking, it would be well to take a reading of the condenser pressure gage and the temperature of the water leaving the condenser. In normal operation the pressure reading should be that corresponding to a saturated temperature 5 to 10 degrees higher than the temperature of the leaving water.

If the temperature difference is greater, a condition of this kind might indicate fouled condenser tubes. However, before deciding that fouled condenser tubes are causing the trouble, there should be more evidence to substantiate this opinion. A check should be made to see whether or not regular treatment of the water in the condenser system is being used. If there is none, determine if the makeup water supply to the tower is abnormally hard. If it is abnormally hard and there is no regular treatment of the water in the cooling tower, there is a good chance that the condenser tubes are fouled with lime deposit.

The situation will be more critical if the level of the water in the tower is not properly adjusted. In a properly regulated tower, there should always be a certain amount of water over-flowing to waste so that there is no chance of concentrating salts in the condenser water system. This will not substitute for good water treatment, but it will help.

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Chemical Over Treatment

If it is found that water treatment is being used, it is still well to examine the pan of the tower to see that water treatment is being used properly. It has been found that overtreatment is just as bad as undertreatment. With overtreatment the material that is used to treat the water is added in such quantity that it actually fouls the tubes.

There could be a situation where the tower is carefully maintained, there is no mud in the pan of the tower and the water is treated, but because of an oversight the float valve supplying water to the tower is inoperative. On a number of installations it has been found too that the tower has been placed so low in the system that a great deal of water in the condenser water system drains back to the tower pan during the shutoff period and this water runs to the waste drain through the overflow. When the system starts up, the water is drawn out of the pan faster than the float valve can supply make-up water and the level is drawn down to such a point that air is carried by the condenser water pump into the condenser. The mixture of air and water causes poor heat transfer in the condenser and the head pressure is high — the same as with fouled condenser tubes.

In looking over the tower, a check should be made to determine whether or not there is mud in the bottom of the pan. If there is an accumulation of mud in the bottom of the tower pan, it is almost certain that there is some mud in the tubes of the condenser. Most centrifugal refrigeration condensers are so designed that they can be cleaned chemically with the head covers in place, or cleaned mechanically by removing the heads.

In considering water treatment, it should be remembered that the system requires the use of open or closed water circuits which may be in contact with the air. Water thus used may become sufficiently unbalanced chemically or otherwise contaminated to cause scaling, corrosion, algae or slime. It is recommended that the owner engage the services of a qualified water treatment specialist to make tests and recommend treatment for the water used. Equipment manufacturers assume no responsibility for failures which are the result of improperly treated water.

It should be noted at this point that all of the above troubles could have been detected and corrected with a good understanding of the pressures and temperatures as reported by the gages and thermometers.

Prominent on the list of educational field trips at the 47th Annual NAPRE Convention is the Stroh Brewery Co. Although officially listed for Monday, Oct. 29th, later registrants will be able to visit the plant by arrangement with Detroit Chapter Convention Tours Committee. Arrivals on Monday will view not only the new additions just completed and projects underway, but those interested in ice cream manufacturing may also interest themselves in this other Stroh enterprise nearby. For the Stroh story, see page 13.

General Maintenance During Operation

With the centrifugal hermetic refrigeration system, control of the system is almost entirely automatic, or in many systems completely automatic. On the completely automatic systems, when the unit has been placed in operation for the first time, the controls properly set, and action checked, the unit can be run without hourly supervision. However, there are certain pieces of equipment in connection with such a system which should be checked and serviced periodically.

The Purge Unit

The most important piece to be serviced is the purge unit. The service on this unit is relatively simple and does not require much time if maintained properly. If neglected, the purge unit can become inoperative and service will undoubtedly involve major parts replacement.

Two weeks after the system has been placed in operation for the first time, the purge unit should be serviced. Following this, the purge unit should again be serviced at the end of the first and second month's operation.

The drive on the purge compressor should be checked. Belt tension should be adjusted so that the pressure of one finger depresses the belt approximately ½ to ¾ inch. The belt should be kept clean and properly adjusted.

The motor bearings should be checked for proper lubrication. Oil should be added in accordance with the motor manufacturer's recommendations. Oil level in the purge compressor crankcase should be checked. The purge compressor should be checked to see that it is operating properly.

The level of refrigerant and water in the purge drum should be checked and any accumulation of water should be drained off. Water which accumulates in the purge unit will separate from the liquid refrigerant. Since the refrigerant is heavier, a layer of water will form on top of the refrigerant. The water and refrigerant can be viewed through the purge condenser sight glass. If water is present on top of the refrigerant it should be drained off through the drain valve on the purge condenser. When draining water, the valve should be left open until no more water is seen through the condenser sight glass.

Periodically, the purge condenser should be thoroughly cleaned out.

General Maintenance

It is well to know and understand the manufacturer's recommendations as far as maintenance of each individual part of the unit is concerned. Manufacturer's instructions will usually detail those points to be attended to and the frequency of inspection or attention required.

Maintenance Program

If long life and efficient operation of mechanical equipment in the system are to be obtained, it is important that a periodic maintenance and inspection be established. As far as a maintenance and inspection program is concerned, there are four major points:

First, it is important that once a program of periodic inspection is initiated, the work be done either by the owner's maintenance personnel or by a reliable air conditioning service contractor.

Second, it is important to see that once such a program is started it is kept up, and each inspection be thorough.

Third, it is important that records be kept of each inspection, indicating the work performed, and the parts or material required. From these records the maintenance man and the owner will always know the frequency of replacements, and have a good running account of the cost required to maintain the air conditioning system.

Fourth, it is important that the operator or inspector understand the system and the parts being maintained so that his inspection is made intelligently. An inspection program is of real value if the inspector knows what he is checking and what the records mean.

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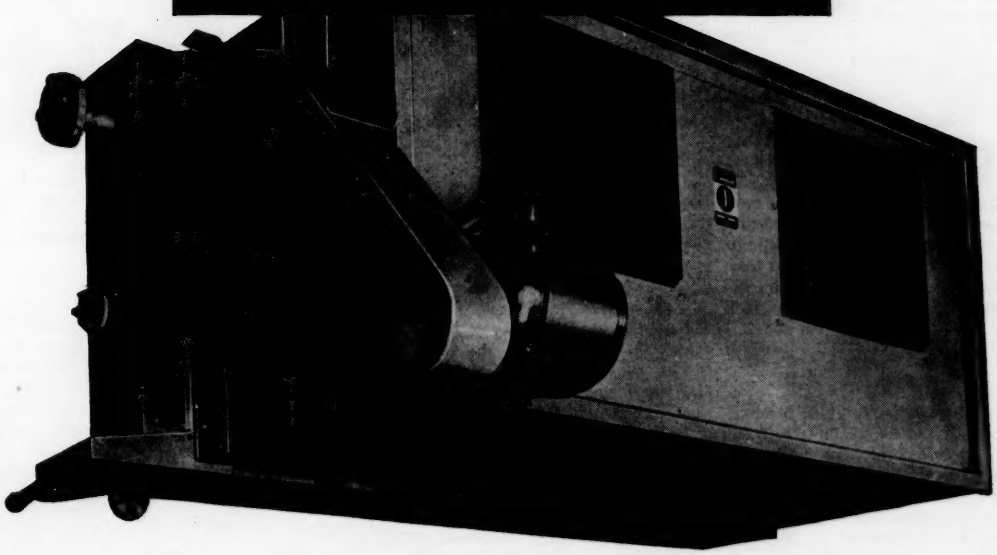

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News Notes and Chapter Activities

Mid-South Chapter Holds Annual Water-melon Cutting

MEMPHIS—Over 150 members, friends and families, were present on Wednesday, August 8, when Tennessee Chapter No. 1, held its annual Round-up and Get-together for a watermelon cutting. The melons were the best of the many delicious lots consumed by this chapter over the years. National NAPRE Secretary, J. R. Kelahan and his family were guests.

In addition to talks made by the chapter president and the national secretary, at which the chapter secretary was honored for 50 years in the refrigeration field, the side diversion was the showing of a travelogue motion picture entitled, "The Land of the Kangaroo, Australia." The motion picture was the courtesy of Miss Thelma Boland, manager of the Modern Motion Picture Service.

The night and weather was ideal for watermelon and it didn't take the crowd too long to consume the supply provided. Two melons were entrusted to the care of the national secretary, to be shared with Chicago Chapter members. However, he reported that the melons met with an accident enroute to Chicago. Since the secretary didn't explain whether or not the accident was intentional, we presume that the weather was too hot to hold the melons for the several day trip and that the worst that befell these products was their consumption by some of the little Kelahans. A number of the members and their guests stayed after the watermelon party to tour the facilities of the Mid-South Refrigerated Warehouse where the party had been held.

First Fall Meeting

Tennessee Chapter No. 1, which believes it is the first of NAPRE chapters to hold its first fall meeting, on Sept. 5, had a combination business-educational meeting. Members discussed the educational program for the coming season. There was a good turnout for the meeting — 36 were present. It was moved, seconded and voted that the Guy King Course be continued. H. L. Todd will continue as the Chapter's instructor. Plant visits, a favorite diversion here, are also scheduled quarterly.

C. W. Sullivan showed a reel of colored motion pictures that he had taken at the Watermelon party. August 8. The pictures were real good and many members enjoyed seeing themselves in action. Leonard W. Dugan, Plant Supt., Winter-Garden Co., Knoxville, Tenn. was elected to membership.

William Kay Passes

Memphis Chapter lost a member of many years standing in the death of William Albert Kay, 50, engineer, Railways Ice and Service Co., Memphis. Mr. Kay suffered a cerebral hemorrhage last May, followed by a temporary loss of memory. Despondent over this and continuing ill health, he took his own life on August 10. He was a Baptist and a 32nd Degree Mason. He was born in Greenville, S. C. and moved to Memphis in 1927.—CHAS. CONLEY

Colton Members Study Newspaper Publishing

SAN BERNARDINO—California Chapter No. 5 members and friends were guests of the Sun-Telegram Publishing Co. at San Bernardino, Calif., on August 10. This NAPRE chapter met in the newspaper firm's conference room for a regular business meeting which consisted principally of the detailing arrangements for the chapter's annual picnic to Devils Canyon.

C. H. Purkiss, program chairman, then introduced Jerry Boyd of the Sun-Telegram Sports Department. Mr. Boyd presented a colored moving picture of the history and services of the Sun-Telegram. This account took the viewers on a tour of the plant from the beginning of a story for publication, to the finished paper in a local home with the head of the household enjoying the feature.

Following the presentation, the group made a tour in person and had an opportunity to see the composers at work, the engraving of plates, the press and all the other many details that go into making of a daily newspaper. Following the tour members and their guests were treated to donuts, cupcakes and coffee in the Sun-Telegram's lunchroom. — H. O. BONTER.

Photographs show tables at the Memphis water-melon party during various stages of the operation. Chas. A. Conley and Alvis J. Clay, both past national presidents, NAPRE, and their firms, the Memphis Cold Storage Company and the Mid-South Refrigerated Warehouse Company, join with Tennessee Chapter annually in acting as host for this affair.

Dixie Members Hold Frolic

NEW ORLEANS—Louisiana Chapter No. 2 is much accustomed to high temperatures and humidities. For this reason, it doesn't "recess" for July and August like many other NAPRE chapters. The July 11 chapter meeting was well attended due to another interesting educational session by Marion "Curly" Olivier, our Educational Chairman. Tom Stokes, everready Professor, did a job again on presenting Chapter 16 of the Guy King Course, "Refrigerated Enclosures". Many questions from the floor were handled by Stokes. At the July 25 session, Tom discussed Chapter 17, entitled "Instruments and Meters".

NAPRE Past President Leo J. Vivien (left) challenges the champ, National Vice President Frank L. Chase (right), while Director John N. Mariakis kibitzes.

On August 3, Mr. Muller, District Manager, Allis-Chalmers Mfg. Co., gave a talk on "How and Why of Centrifugal Pumps". A film was also presented on the fundamentals of centrifugal pump design and construction. The subjects of application, maintenance, etc. were discussed following the film. This was the longest meeting of

A portion of the New Orleans Chapter Picnic crowd watch the childrens' activities from shade provided by moss covered oaks at City Park, Aug. 26.

the year because of the great interest in this topic and the questions that followed. Professor Stokes, on August 22 presented Chapter 18, entitled "Heat Calculations". He brought samples of various parts of refrigerating systems to be looked over by the membership.

The Picnic Committee, Chairmanned by Gerald Vieages and Co-Chairmanned by Pres. Damien Fischer, staged this social on Sunday, August 26, 1956 at City Park. Dancing, prizes and refreshments were made available for all members and their families. A shelter was reserved for all

Picnic Committeemen pose with the equestrian foot gear. L to r, Jerry Vieages, Chairman, Pres. Damien Fischer, John N. Mariakis.

day, supplied with a "Juke-Box" and 24 of the latest records. A microphone and two loud speakers were provided by Al Ballanco. A softball diamond was rented for all day. The only game played was between the Vivien Wildcats and the Joe Vernaci Pelicans. It turned out a 7-7 game after 7 rough innings.

The Chase and McGovern combination on the horseshoes was beyond reproach. They could not be beat. All the children had a swell time, too. They played games, races, etc. All were awarded prizes. The ladies were well represented. They participated in many of the events and danced quite a bit. Pelican Ice and Cold Storage kept the beer and soft drinks cool, plus the transportation of same to the picnic grounds. Gabler Insulation helped clean the mess up and returned all the bottles, etc. Besides these two, the following firms sponsored this picnic: Reilly-Benton Co., G & M Electric Co., Nola Sales, Encoh Sales, Gulf-York, Inc., Marks, Marine & Mill Supplies, and Baldwin-Hill. — JOHN N. MARIAKIS.

Members at Large Describe Meat, Fish Freezing And Storage Construction

New Orleans — Correspondence from foreign Members-at-Large continues to contain interesting news. Bill Syme of Auckland, New Zealand writes, "When I was at the convention in 1953, it didn't seem very

(Continued on page 73)

NAPRE Member-at-Large, Girard Bourret, sent IR (through Frank L. Chase, NAPRE Vice President) this illustration of the establishment which he supervises, The Refrigeration Depot, Provincial Dept. of Fisheries, Quebec.

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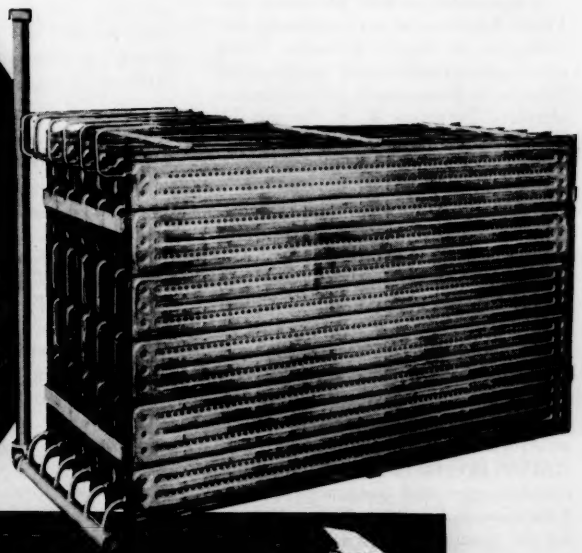

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From the President's Desk

Convention Plans Completed and Term Ends
Etzel Expresses Gratitude for Support in His Term

DETROIT Chapter, NAPRE's Educational Committee and your National Officers have completed all but a few small details on the 47th Annual Meeting which will take place on October 29 through November 2. An abbreviated program appears in the column with this message. The largest Post-World War II attendance yet, is expected from looks of the advance registration.

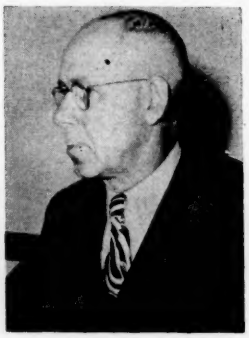
Members who haven't made or completed plans to attend should do so immediately. It will assist those responsible in providing accommodations entertainment, and, of course, education. Other Industrial Refrigeration readers also, are cordially invited to join us at at this convention.

Assistance Acknowledged

Before NAPRE's new corps of officers take over on November 2, your President wants to take advantage of this — the final message of my term — to thank all the officers and committee members for their help in making this term a pleasant and, I hope, a successful one in the consideration of the membership.

Vice-presidents Bert McKenna and Frank Chase were very active in following up on chapter activities. Chase corresponded with many members-at-large with good results toward future chapters. Directors W. R. Burnett, H. Branham, Tom Weatherford, Roy Burns and John Mariakis gave needed help to the individual chapters as well as National headquarters. Director O'Neill made contributions to the Safety Program.

Grateful thanks are extended also to our Educational Committee Chairman, Dean Harold P. Hayes, who, as always, did an outstanding job in handling the Question Box in INDUSTRIAL REFRIGERATION; to Vice-chairman Guy King for handling the Instructor's Manual and "Planning an NAPRE Program" for the individual chapter's use and guidance; and to Educational Director Regis Gubser for the practical operating and maintenance papers introduced in the NAPRE official section of IR this year; and his assistant Elmer Johnson for his help. The Publications Committee, under the chairmanship of Erich B. Utescher, did an outstanding job in making NAPRE's 1956 *Operating Data Book* a success.



Leroy Etzel

Thanks of the President goes to George Paulick who with his committee were active in our membership drives; thanks also to S. Averell Cole, Chairman of the Industry Relations Committee, for his help, and to Secretary J. R. Kelahan and his assistants — Gladys F. Fitch and Geraldyne V. O'Neill — for their work. One does not realize the work that is accomplished in the National office until he has served as President.

Thanks also to Leland Kenagy, our Treasurer, and E. T. Quinn, our Financial Chairman, for their guidance and financial counsel. The Association, as well as your President, is grateful to Honorary Member, H. T. McDermott and INDUSTRIAL REFRIGERATION for generous support.

Venemann Education Fund Receives Industrial Support

The Venemann Memorial Educational Loan Fund has continued to grow after its inauguration in Past President Gubser's term of office. This idea has gained support from the Industrial membership recommended at the last convention. All these firms will be honored at a breakfast at the Detroit convention.

While the goal your President had set up for the 1955-56 term has not quite been accomplished, we did keep our financial status on the black side of the ledger which is gratifying.

I am looking forward to meeting again many of our members and officers at Detroit when we will partake of an excellent educational and social program which is listed in the next column.

L. Etzel

47th Annual NAPRE Convention Program

MONDAY, OCT. 29

PM Advance Registration
Stroh Brewery Co. Tour
Special Directors Meeting

TUESDAY, OCT. 30

AM Registration
Exhibit Opening
Annual Meeting Convenes
Safety Session
"Manufacture and Inspection of Unfired Pressure Vessels"
PM Engineering Session
"Contract Services and Maintenance Programs"
"Preventive Maintenance by Plant Personnel"
Chapter Problems Clinic
EVE Statler Hotel Tour of New Air Conditioning Plant
Annual Informal Party
Airtemp Div., Chrysler Corp., Hosts

WEDNESDAY, OCT. 31

AM Breakfast Session
Presentations
Industrial Membership Certificates
Membership Contest Trophy Awards
Engineering Session
"Nuclear Energy Power For Industry"
"Central Station Air Conditioning With Vapor Absorption Plants"
PM Field Trip Events
"Utility Refrigeration" — Tour of Northland Center
"A Product Engineering Study" Tour of GM Technical Center
EVE Exhibitors Frolic
Halloween Party
Chicago Chapter, Hosts

THURSDAY, NOV. 1

AM Engineering Session
Transportation Refrigeration Forum
"Servicing Truck Units"
"Maintenance of Mechanically Refrigerated RR Car Units"
"Trouble-shooting and Service For Mechanical Reefer Car"
"Vacuum Cooling the Field Loaded Refrigerator Car"
"Application of Centrifugal Compressors to Industrial Ice Making"
PM Engineering Session
"Package Food Freezing and Cold Storage Systems"
"Hermetic Centrifugal Compressors Come of Age"
Annual Business Meeting
Election of Officers
EVE Officer Installation and Reception, Detroit Chapter, Hosts
Annual Dinner and Dancing

FRIDAY, NOV. 2

AM Annual Directors Meeting
National Committee Meetings
Post Convention Tours

(Continued from page 71)

difficult then to return to another of your conventions, but I can assure you that when one gets back home, U.S.A. seems a very long way away. However, INDUSTRIAL REFRIGERATION certainly keeps one in touch with what is going on."

Freeze 18,000 Lambs Nightly

"We have had a very busy time here in the refrigeration world since my return. My firm, the Auckland Farmers Freezing Co-op. has gone in for faster freezing of lamb carcases in all three meat packing plants. Now we have capacity for the freezing of 4,000 lambs per night at Moerewa, 6,000 at Southdown, and 8,000 at Horotiu.

"The other interesting thing about our undertaking has been the develpment of the chilled beef trade with England, where we have shipped many thousands of prime beef carcases in the chilled condition. That these carcases arrive in London in tip-top condition up to 45 days after dressing and chiling, is great testimony to the close control of refrigeration.

"Another thing that may interest our NAPRE members and IR readers is an inovation at our last building extension at Moerewa. We put in 14,000 square feet of Perlite concrete floor with no other insulation. This building has been in operation six months now with good results."

Fishery Product Experience

Alaskan Member-at-Large, Frank D. Montogomery of Anchorage, was very happy to learn that the fellows in the far corners are not forgotten people. Most of his experience in refrigeration in Alaska has been in the freezing and storage of fishery products.

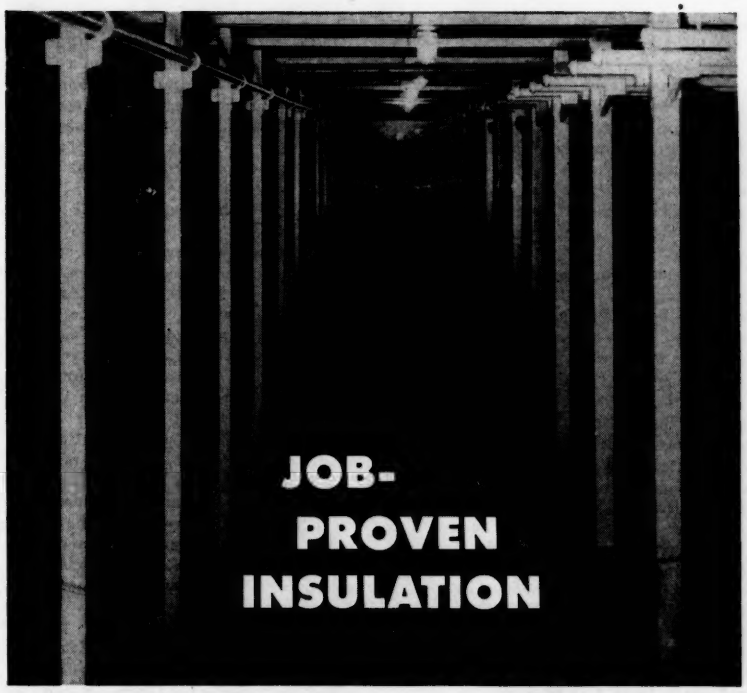
Another interesting letter was received from Girard Bourret, Department of Fisheries, Rimouski, Quebec, Canada, giving a few details of his organization. He wrote, "I am the Superintendent of a cold storage plant of a million pound capacity. I have three chill rooms, one for fresh fish, one for meat and one for fruit and vegetables. These three rooms are located in the basement. On the main floor, I have a locker room with 600 lockers and two freezers, one for meat and for fish. On the first floor there are six storage rooms for frozen products. I use these to take storage of fish, butter, ice cream, fruits, meats.

"Regarding the refrigerating system, I have a calcium brine system in the cold rooms. The brine is refrigerated by two ammonia compressors: one 7½ x 7½ inch, and the other one a 5½ x 5½ inch; automatic system. The machinery is a Linde-Hall Canadian Refrigeration system from Montreal. The plant is in operation since Summer, 1951. Three mechanical men are under my responsibility.

Volunteers Chapter Assistance

"In the area, I am alone and I think for the present time, it would be quite hard to organize a chapter because the big cold storage plants are in Quebec or Montreal cities, and the Gaspe coast. Anyway I will work close with NAPRE to have a chapter.

"I am also teacher of refrigeration for Laval University in the School of Fisheries, Ste-Anne de la Pocatiere. I have my classic



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degree; that is, my B. A. and also my Laval University degree, B. Sc. P. The refrigerating field is very young in the Province of Quebec. We have a lot of work to carry on and we have a lot to learn."

Member Walter C. Wolgast of Hygeia Refrigerating Company, Elmira, New York corresponded, saying he plans to attend the convention in Detroit this year and will gather all necessary information and details then for a chapter formation in his city.

Also heard from was C. Tom Baker, consulting engineer, of Atlanta, Georgia. As a member of NAPRE's Educational Committee, we hope he favors the convention delegates with a visit.

Correspondence has been received from the following: Virgil Breshears and Herman W. Buskirk, both of Anchorage; Allan A. Lowrance, Sitka; Thomas P. Monroe, Petersburg; William P. Sterling, Spenard and Donald J. House, Wrangell, Alaska; R. J. Slessar, Richmond, E. I., Victoria, Australia; John A. Kennedy, Saint John, N.B., Canada; and R. P. Driscoll, Moncton, N.B., Canada. Here in the U.S.A., mail came in from Allen J. Scott, Las Vegas, Nevada; Frank L. Kain, York, Pa.; H. Levine, Schenectady, New York; and Wm. H. McCollough, Findlay, Ohio.

Describes Chemical Plant

Gustave Beinert sent in an application for membership for Willy Bastinie, an associate of his at Geigy Chemical Co., Ardsley, N. Y. The plant is located in Ardsley, on the Pictman Division of the New York Central. He comments:

"At the present time, we have a 500-ton Worthington centrifugal compressor driven by a Worthington turbine for air conditioning three buildings. There are other compressors going in the different buildings that are not connected up and it will be another month before everything will be in running order. In time, there willl be more buildings with extensions on the present refrigeration system, plus another compressor and boiler.

"I have received the Liquid Ammonia Recirculating book as well as the one by Ideal Electric and the sheet on Compressors for Food Freezing.

"In regard to a chapter being formed in New York City, the man or men who get one formed and hold it together for five years or more should get a medal of some kind. I know, as I was President of one in New York myself. "Why a lot of men in New York do not care to broaden their minds on refrigeration once they have their N.Y.C. license is beyond me. Some of them do not care if the plant is run efficiently or not. Sure, if a chapter was formed in N. Y. I surely would travel to it as one can get more out of chapter meetings than he can get from just being a Member-at-Large."

Another Member-at-Large, Robert B. Brown, is returning to Caracas, Venezuela, after working on a large cold storage and freezer project in Bangkok, Thailand, as project consultant and supervisor of construction. — Frank Chase

Los Angeles Fishermen Focused In California Spotlight

LOS ANGELES—With Los Angeles Chapter, NAPRE, invoking its customary moratorium on meetings during July and August, news of the summer month activity dealt largely with the doings of the chapter's deep-sea fishermen. Some half dozen trips were made to various points along the southern Pacific Coast, and with the personnel of the trips usually different on each occasion. These charter parties and trips were instigated several years ago when various members asked Rudi F. Kettler, who is himself an enthusiastic fishermen, to arrange some trips. Rudi has since then been the unofficial "Skipper" of nearly all deap-sea fishing trips.

For the most recent trip, the group chartered the S.S. Sabre and took off from Long Beach Harbor on August 31. The regular captain of the *Sabre* was not available this time, and as a result the NAPRE group failed to get as good fishing as usual. According to Kettler's report of the affair, the new captain followed a route east of Catalina Island, instead of going along the west end of Catalina and Santa Barbara Island. While this trip was not reported to have been as successful as others, Kettler stated that a reasonable amount of fish were nevertheless snagged.

Another summer trip, also aboard the *Sabre*, took the NAPRE sportsmen to San Clemente Island for albacore. Ten were aboard but a total of only 17 fish were caught. Kettler, Cliff Nordholm, and Victor Stubblefield were among the NAPRE members participating.

After the San Celmente trip, Kettler reported, some of the boys wanted to go fishing down Mexico-way, and a charter party for a dozen or so members of Los Angeles chapter was arranged. The destination was Ensenada, Mex., but instead of going out to the outer islands for the larger fish, the boys seemed to want to stay in Ensenada Bay, because they started to hit seabass up to 12 pounds at the first spot they stopped. Cruising out to the deeper waters later on, the gang caught a good batch of barracuda, yellowtail, halibut, and ling cod.

Prior to the summer close-down on meetings, Kettler and three companions motored to San Felipe, Mex., which is a nine hour drive from Los Angeles through the Imperial Valley of California, through Mexicali, Mex., and 127 miles south on the peninsula of Lower California. This is reported to be one of the finest fishing areas known anywhere. The NAPRE quartet went after Toutouva, a fish found only in the upper part of the Gulf of California and in China. It is a type of fish, Kettler reported, that lives in water that is less branckish than regular sea water and thrives in the gulf because the muddy Colorado River empties into the gulf. An idea of the type of sport they enjoyed may be obtained from Kettler's report that the smallest fish caught weighed 68 pounds and the largest 135 pounds.

On the next trip, ten NAPRE members and friends journeyed out of Long Beach, Calif., on the SS Saber for San Clemente Island, 56 miles off-shore. They hit the jackpot again, scoring with 53 good-sized albacore, a fish that is regarded by many as the fastest in the sea.

In mid-September, Kettler was busy assembling a group for a trip to Ensenada around the end of September, at a spot where late summer and early fall fishing is expected to be excellent. Kettler reported that some of the best fishing the NAPRE crowd has experienced has been at Ensenada, and cited a trip on which he, Jim DeLorie and Herb Royden caught 48 large white seabass on day and followed with 40 more the next day. "This," Kettler said, "is the kind of fishing that gets a man stimulated and prompts the members to ask for more and more fishing trips."— FRED HERR

Industrial Membership From Rio Grande Valley

LE FERIA—Although Rio Grande Valley has been recessed for the summer months, as is its practice, its members have not exactly been dormant. This chapter is proud to claim its first Contributing Industrial Membership in NAPRE. The firm taking out the industrial membership is the Edinburg Ice and Cold Storage Co. of Edinburg, Texas. Angus M. Casberg, manager of this firm and a past president of NAPRE, will be on hand at the 47th convention to accept the certificate of membership for the Edinburg Ice and Cold Storage Co.

Rio Grande's former secretary, Armin Doneis, has kept his many buddies and national officers informed of his whereabouts through postcards from such far away places as Paris and Copenhagen. Doneis is a delegate to the 41st Esperanto Congress at Copenhagen. He writes: "2200 delegates from 42 countries use only one language in mammoth-8-day demonstration of Esperanto's utility in international life. Complete freedom from language barriers, translations and confusion prove wisdom of early adoption of Esperanto in work of United Nations and UNESCO scientific conferences. Here each understands all." — BARNEY MAJESKI

Ice Industry to Issue New Facts Booklet

THE Association booklet "Facts About the Ice Industry," prepared during World War II is to be revised. Its revision was proposed by the Sales and Marketing Committee and approved by the Board of Directors at the July meeting. This booklet was originally produced to make available in concise, concrete form the facts and figures of the industry. It was used extensively in getting publicity for the ice man, in working with the government agencies dealing with the industry's operations. The new booklet, it is announced, is expected to be available in the Spring of 1957.

Shelf Life of Frozen Poultry Meat After Thawing

A SURPLUS of broilers in the fresh market often calls for the diversion of some of these birds into frozen channels. An investigation of the possibility of freezing such broilers in tray packages and subsequently thawing and holding in the nonfrozen condition for normal marketing periods was reported at the annual meeting of the Poultry Science Association. The study was made by J. V. Spencer, E. A. Sauter and W. J. Stadelman. Storage life of such broilers was determined by odor and slime detection methods. Effect of freezing and thawing plus refrigerated holding, for six days, on the flavor of birds so treated was determined by comparisons with fresh killed broilers.

It was discovered that the number of days to spoilage after thawing of broilers held frozen up to two months in tray packages, was the same as for unfrozen controls. Flavor comparisons of fried meat sampled from frozen and fresh broilers indicated no detectable differences. Use of extracted broth differences was detected by a trained panel of judges. Bone darkening comparisons between fresh controls and birds held frozen for different periods showed no bone darkening in fresh controls. However, bone darkening was observed in all broilers subjected to freezing. Length of frozen storage had no effect on the degree of bone darkening.

Freon Used For High Temperature Lubricant

AS REPORTED in Mechanical Engineering, Freon has been tried out as a lubricant for machinery run at high temperatures.

Known for their ability to withstand temperatures at which ordinary lubricating oils would evaporate and might catch fire, the Freon gases have been suggested as substitutes for liquid anti-friction materials.

Their behavior in preventing surface damage to machine parts made of various kinds of hard metals has been studied by S. F. Murray, R. L. Johnson and M. A. Swikert of the Lewis Flight Propulsion Laboratory of the National Advisory Committee for Aeronautics, Cleveland, Ohio.

Action of the gaseous Freons, which owe their fireproof quality to the chlorine and fluorine combined with carbon in their structure, seems due to a slippery film formed by chemical combination of the gas with the machine's iron or other metal.

Tool steels gave the best performance with the gaseous lubricants in this study, and results were most satisfactory when the two surfaces being lubricated were of nearly the same hardness.

Tool steel in contact with beryllium copper or with monel metal was effectively lubricated, but stainless steel showed excessive damage. Parts plated with silver to reduce friction were also damaged by the gaseous lubricant.

Norwegian Frozen Fish

NORWEGIAN frozen fish, whose products are sold in the United States under the Frinor label, exported a total of 22,000 tons of frozen fish fillets in the last twelve months. Representing a ten percent increase compared with the previous twelve-month period, the exports are equivalent to about 50,000 tons of raw fish. Besides the United States, Frinor frozen fish products are now sold in twenty foreign countries, including Cyprus, Belgian Congo, South Africa and Australia. New markets are being added despite sharper competition and other difficulties.

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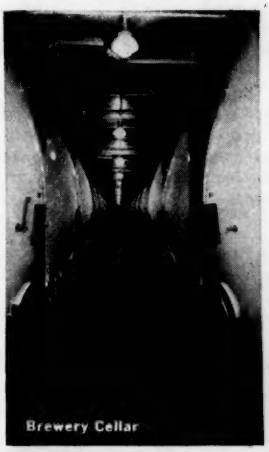
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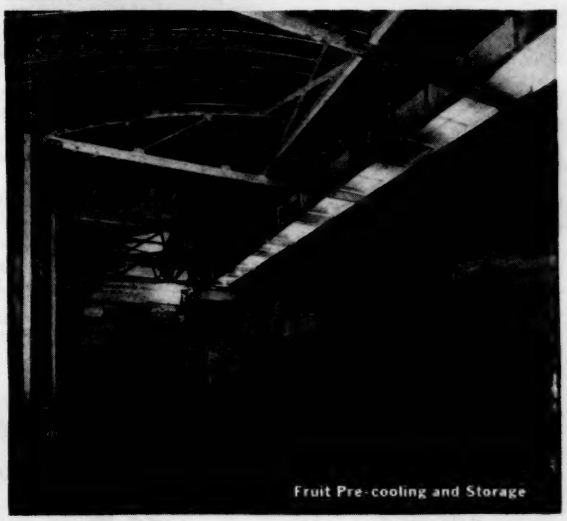
Fruit Pre-cooling and Storage

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District Engineers in Principal Cities of U. S. and Canada

Need More Humidity

QUESTION NO. 1129: In a building 80x120x12 used by a local meat packing firm we have a refrigeration problem. Please advise how to reach and hold 92 percent humidity.

At present we are able to reach no more than 85 percent humidity without moisture falling to the floor. York air pressure jets are used, but our air water moisture isn't breaking up properly. One 20 hp compressor and one 25 hp compressor handle the cooling by use of a large three-speed blower.— L.A.D., Grand Junction, Colo.

EDITORIAL NOTE: Several contributors have submitted excellent comments on this very interesting problem. To conserve space, I have consolidated the contributions of M. B., Denver and J. D., Memphis, among others, into one answer. — H. P. Hayes

ANSWER: Possible causes and cures of your troubles are summarized as follows:

(1) The oil separator may not be doing a good enough job of removing oil from the air as it leaves the compressor. Moreover, cooling of the air as it moves along to the nozzles further aggravates this condition. As the air passes through the nozzles, turbulence causes oil impingement and collection on the nozzles. This has the effect of partially shutting off the nozzles and destroying the design pattern of air and moisture break-up and throw.

Cure: If a purer quality of air cannot be provided, clean the nozzles frequently. You may find such cleaning necessary two or three times a day.

(2) The area of coverage of each nozzle might be too great.

Cure: Add more nozzles or replace with different design.

(3) You may not have sufficient quantity of air flow, although this is doubtful.

Cure: Increase capacity output of fan.

(4) You many be operating at too low an evaporator temperature.

Cure: If refrigeration equipment is adequate in size, increase the evaporator temperature as much as possible without shorting the system of capacity to the extent that it would not be adequate to handle the cooling properly.

(5) You many not be getting proper moisture particle size and uniform particle distribution in the air stream.

Cure: Use eliminators to screen out bigger particles and return them to the spray system supply tank.

NAPRE

Question Box

The National Educational Committee, NAPRE, answers monthly in this column, operating problems forwarded by members. The Committee appreciates answers from the field. Address questions and answers to Prof. Harold P. Hayes, Dean of Engineering, State Polytechnic College, San Luis Obispo, Calif.

If you feel it is not worth while to experiment with your present system, you could consider injecting live steam into the air-handling equipment or into the conditioned system directly. In this case, be sure to admit the steam through a control valve and perforated tube to avoid surges of steam falling out immediately as condensed moisture. — H. P. Hayes

Refrigeration for Ice Making

QUESTION NO. 1130: We desire comparative data as to amount or cost of refrigeration required for one ton each of clear ice and so-called tombstone ice. We cannot find anything in data books on ice manufacture.— H.C.D., Colo. Springs, Colo.

EDITORIAL NOTE: "Tombstone" is generally a term applied to either clear or opaque ice which has stood in the sun for some time. The term is descriptive of its appearance. It is believed that HCD meant opaque. Again, quite a number of answers were received. Two most representative follow:

ANSWER No. 1: With reference to the difference in cost between clear ice and opaque or white ice, we have never attempted to set up any operating costs between the two classes of ice, and in some cases you will find that you make clear ice cheaper than the opaque ice, and in others it is reversed. Based on our experience, I do not believe it would be possible to give any rule of thumb on comparative costs.

The quality of water is one thing that will enter into the cost materially. In some cases it is possible that the pumping of cores would effect a saving in the production cost, due to the elimination of the highly concentrated water in the cores; thus in numerous cases shortening the actual freezing time of a block of ice. Again, water that is fairly low in solubles might produce ice at a cheaper over-all cost without air agitation.

Another item that would enter into the picture would be whether the water was treated with lime and soda or whether it was taken directly from the source and frozen without further treatment.

I am sorry that I cannot give you any percentage figure which I think would be applicable to an average cost. — R. A. O'N., Corpus Christi, Texas

ANSWER No. 2: NAPRE's Past President and our District Engr., Harry T. Holbrook, says, "Experience shows anywhere from 5 to 10 percent with an average of about 7½ percent in favor of white ice".

As you well know, the size of the plant, whether they are making both clear and white ice in the same plant, operation time, ideal water conditions, etc., all would have a factor in these cost figures. Harry feels that the 7½ percent is fairly close as an average figure. — R. W. D., San Francisco, Calif.

Measuring Odors

QUESTION NO. 1131: Have any systems or instruments for measuring and classifying odors been developed or must we still rely on our noses?— O.R.S., Memphis, Tenn.

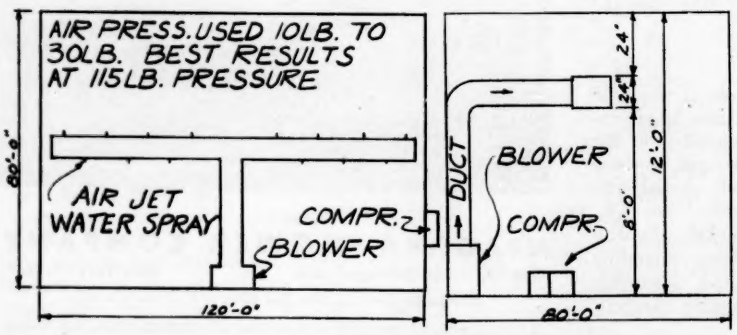
ANSWER: I know of no widely accepted and undisputed instruments for measuring the intensity of odors. The human nose is still about the most reliable instrument we have, and even that is not too reliable. Tests have shown that the minimum difference of odor levels recognizable by the average person is about 30 percent. For example, if a certain odor were arbitrarily given a value of 10, it could change to 7 or 13 value before the change would be noticeable.

A great deal of research is being done in the area of producing objective methods for odor measurement but there is still a long way to go. Various appliances have been marketed under such descriptions as scent-meters, odorimeters, olfactometers, osmoscopes, etc., but their success has been questioned by experts. — H. P. Hayes

Vacuum Gages

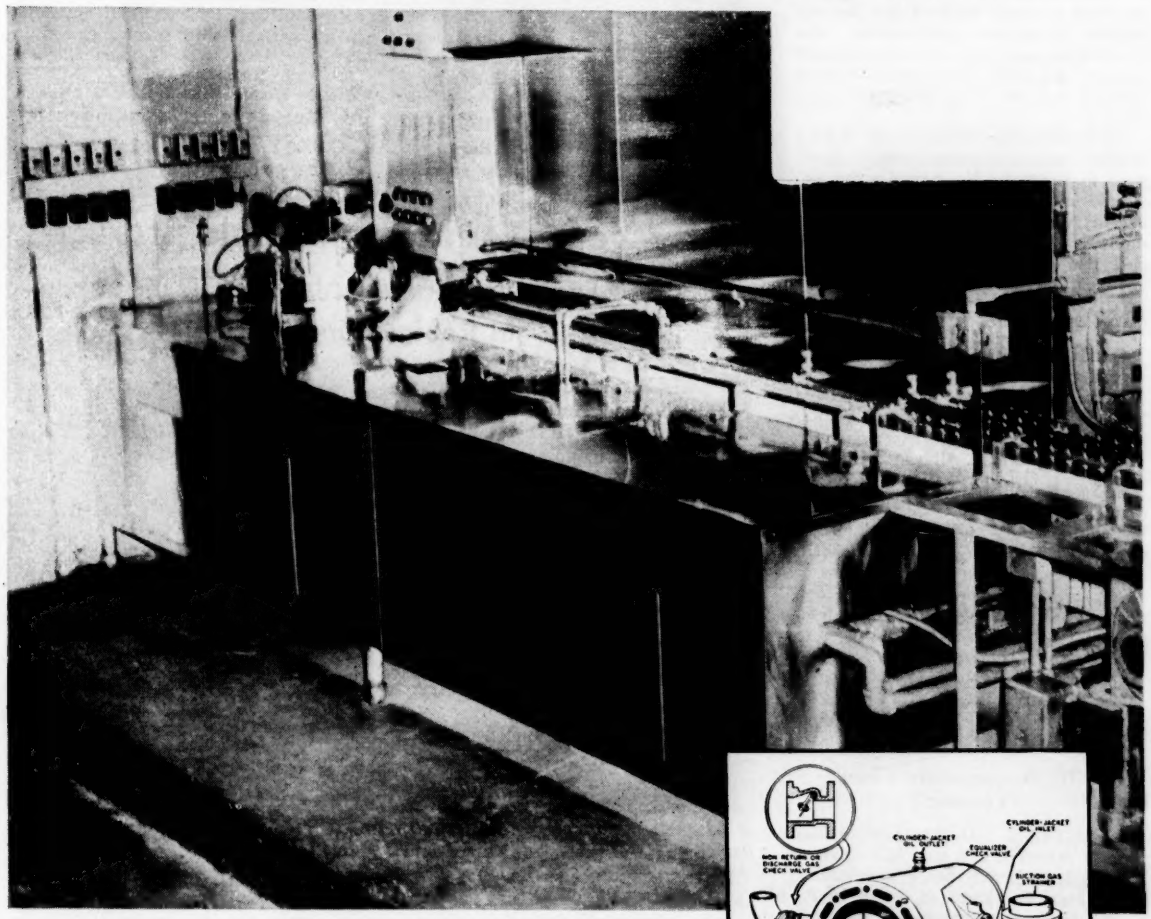
QUESTION NO. 1132: On what principle do vacuum gages work? Are the instruments used for measuring moderate vacuums applicable to very high vacuum.—A.C.S., La Crosse, Wisc.

ANSWER: A vacuum is merely an absolute pressure which is below atmospheric. In general, gages to measure absolute pressures about 0.1 millimeter of mercury (Hg) rely on the force exerted by the fluid to produce a pressure reading. For example, the typical Bourdon gage uses the deflection of a bent, oval cross-section, tube to give an indication of pressure changes. The ordinary barometer or manometer is another illustration of a

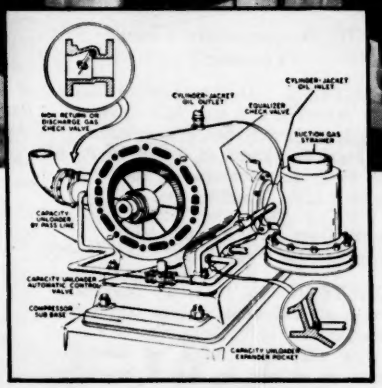


Continuous Freezing of Retail Cartons at Rate of 180 per Minute Requires Only One Operator

at Stokely-Van Camp, Inc., Winnebago, Minn.



Frozen food packages entering the Freezing Equipment Sales continuous freezer from high-speed filler. Compact insulated room freezes 24,690 12-oz. packages at one time. Only the product enters and leaves the room.



Stokely-Van Camp selected F.E.S.-Fuller Rotaries to provide a flexible two stage refrigeration system capable of matching a variable refrigeration load. Stokely-Van Camp's battery of Plate Frosters, loose product Belt Freezer and continuous Package Freezer are served by F.E.S.-Fuller Rotaries under varying refrigeration requirements from 3" to 10" Hg. Vacuum.

Compactness and simplicity of design make **FES-Fuller** Rotary the most popular refrigeration booster. Rotary principle of gas compression insures high efficiency at large gas volumes to give compact and light weight machine generally smaller than the driving motor. Absence of suction and discharge valves, connecting rods and crankshaft give a simplicity in design which guarantees low maintenance cost and quick overhaul if any plant shutdown is necessary.

Whatever *your* refrigeration requirements, turn to service-proved **FES-Fuller Rotary Booster.**

Write for more information.

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FREEZING EQUIPMENT SALES, INC., 1405 N. DUKE Street, YORK, PENNA.

Qualified distributors in principal cities

LOW TEMPERATURE FREEZING EQUIPMENT

force producing a deflection which is proportional to pressure.

For absolute pressures below 0.1 millimeter of mercury, the force is so small that it cannot be accurately measured. Consequently, some other property which is dependent on pressure must be measured and converted to equivalent pressure reading. Temperature and volume, heat conductivity, viscosity, thermal molecular pressure, and ionization are typical properties that will serve as a measure of pressure.

For example, one device employs a strip of fibre (quartz is typical) which is excited to vibration. The time for the amplitude of the vibration to die down to half its value is a measure of the pressure. Most of the methods are so complex that space does not permit their inclusion here. — H. P. Hayes

Capillary Tubes

QUESTION NO. 1133: I have observed that smaller packaged air conditioning units are using capillary tubes rather than expansion valves. Do capillary tubes have any particular advantage?—C.E.R., Chicago, Ill.

ANSWER: A capillary tube is a very simple device and, therefore, results in low initial cost, with no maladjustments or similar problems in operation. The main disadvantage is that it offers no means of adjustment for various operating conditions. It will probably continue to be used in mass produced "packaged" units where cost is a very important competitive factor and adjustment to load variations is not critically important. — H. P. Hayes.

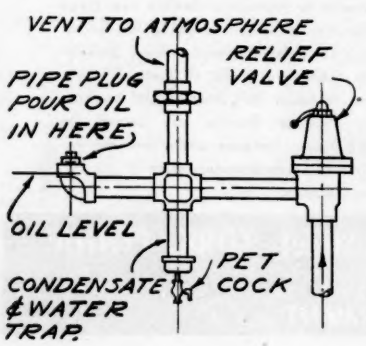
New Questions

Will NH_3 Temperature Change If Container Volume Triples?

QUESTION NO. 1134: Ammonia at 40 F is stored in a 5 cu ft container. If it is transferred through an orifice to a 15 cu ft container, what would be the final temperature of the ammonia?—R.L.R., Tampa, Fla.

Is Corrosion Prevention Idea Acceptable In Practice?

QUESTION No. 1135: To prevent corrosion of NH_3 relief valves (similar to question No. 1126, September I.R.). why not fill them with oil above the seat as shown in sketch below? Water being heavier than oil, any water entering through the vent pipe will drop down into the pipe leg where it can be drained out.—K. K., Mil., Wis.



Cooling Tower More Effective If H_2O on, Above or Below DB

QUESTION No. 1136: Does it make any difference in cooling tower performance whether the incoming water enters at a higher or lower temperature level than the dry bulb of the air? In other words, if the air is 95F DB and 70F WB, will the tower work as well with 100F water as with 90F entering water?—C. T. I., Kansas City, Mo.

Can NH_3 Be Used to Trace Refrigerant-12 Leaks?

QUESTION No. 1137: What, if any, are the objections to adding from 3 to 5 percent by weight of ammonia to a Refrigerant-12 system to aid in detecting leaks?—D. B., Los Angeles

Wants Description and Use Of AC Motor Starter Component

QUESTION No. 1138: What is a shading coil and why is it used?

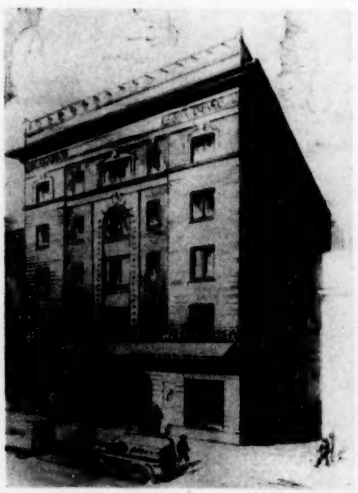
Fifty Years For Memphis Cold Storage

Chief Engineer Honored Also For 50 Years In Refrigerating Field

GOLDEN Anniversaries aren't celebrated so often that persons or firms would ordinarily take it in their stride and point out similar achievements of others, especially employees. However, Memphis Cold Storage Warehouse Co. not only celebrated theirs this year, but their executives took the trouble to point out to an inquiring press that their chief engineer was also completing 50 years in the field. For his achievement, Chas. A. Conley, Sr., was designated "Mr. Refrigeration of Memphis" on August 8.

When this firm announced its 50th year of service by providing its customers with some fine felt-backed bronze desk paper weights, a number of those clients tipped off INDUSTRIAL REFRIGERATION. At the same time NAPRE members in Memphis were pointing to Conley's two and one-half decades of service.

An inquiry to the firm brought a modest review of the Memphis Cold



Memphis Cold Storage Warehouse constructed in 1906 in the heart of the City's cotton, hardwood and food markets.

Mid-South Refrigerated Warehouse Co., erected and put into operation in May 1953 by the same management.

Board of Directors for the two refrigerated storage firms are: left to right, Chas. F. Goodman, Vice-President; Herbert Glazer, Secretary; Wm. W. Goodman, President; T. E. McCrary, Vice-President & General Manager; Abe Goodman, Treasurer.

Storage Warehouse's 50 years of reliable and friendly service, and also the following comment on Conley: "We feel that you are familiar enough with Charley and also know how we feel about him to better put into words what we would like to say, rather than for us to try to do it.

"Please come down to Memphis and maybe you can get in his own words, the facts relative to his long and splendid engineering career", came from T. E. McCrary, vice-president and general manager. "As you all at IR know, he is one of the few remaining self-made engineers of the old school. NAPRE Chapter, Memphis, will have its annual watermelon party at our new Mid-South plant on August 8. It is respectfully suggested that you get your story then."

Designated Mr. Refrigeration

Conley was host to Tenn. No. 1 Chapter NAPRE, as has been his custom over years, for the annual watermelon affair. However, while he was preparing to make Chicago visitors his guests of honor, his own assistant chief engineer, Memphis Cold Storage and Mid-South management, and Memphis Chapter officers were secretly planning a 50-year celebration for him.

That night, John H. Robinson, chapter president and chief engineer, West Tennessee TB Hospital, presented a testimonial to Conley which read as follows: "The Tennessee No. 1 Chapter, NAPRE, presents this testimonial to Chas. A. Conley, Sr. who has been recognized as 'Mr. Refrigeration of Memphis' for a period of 50 years, and who has distinguished himself as one of the founders and continuous members of the organization — presented this 8th day of August, 1956."

Memphis Waterfront Location

Located on Front Street, the Memphis Cold Storage Warehouse Co. tops the bluff which overlooks the Mississippi River. It has had an enviable record in providing, without interruption, complete facilities for storage of perishables — shell and frozen eggs, dairy products, meats, sea-foods, frozen and fresh fruits, vegetables, juices, and nuts, for this city which is known as the cotton and hardwood center of the world. Twenty-five modern cooler and freezer units afford individual storage space for various commodities, with a capacity of over 15,000,000 pounds. Most of these rooms are flexible and can be used for coolers or low temperature freezer storage.

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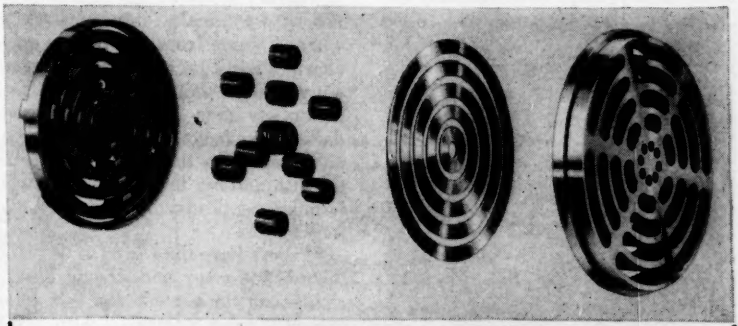

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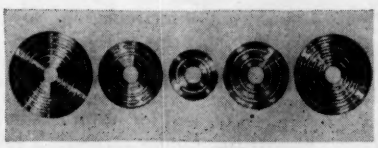

Our detailed proposal for improving the efficiency of your compressor will be sent you without obligation. Send us the name, bore, stroke, and speed of your machine.

Check THESE VOSS VALVE ADVANTAGES:

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- less power consumption
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- normal discharge temperature
- lower operating costs
- utmost safety

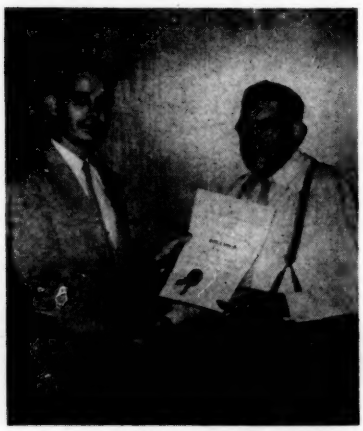
J.H.H. VOSS VALVES

J. H. H. VOSS CO., INC.
785 East 144th St., N. Y. 54, N. Y.

In May 1953, the same owners opened the Mid-South Refrigerated Warehouse Co. This building, all on one level, has five 50 x 200 ft units operated at minus 20 F. It is equipped with 20 blast freezing tunnels at minus 30 F. and four 50 x 50 ft units at minus 10 F. Refrigeration is by Niagara Blower No-Frost System and York refrigeration equipment. Services offered are in-transit and local distribution refrigerated storage, pool car deliveries, quick-freezing of fruits and vegetables for processors and cold packers, and meat freezing for meat packers.

Chief Engineer's Career

Charles Andrew Conley, Sr. was let out of service of the Rock Island Railroad in May 1907 during that year's panic. The Memphis Cold Storage Warehouse Company plant was being built. He went to work for the Westerlin and Cambell Co. who were the general contractors installing the equipment in the plant. They represented York Corp. who had sold the



Chas. A. Conley, Sr., is designated "Mr. Refrigeration of Memphis" by Tennessee NAPRE Chapter No. 1. John H. Robinson, Chapter President, presents the testimonial to Conley, who celebrated 50 years in the refrigerating industry.

refrigeration equipment and all of the piping and coil systems in the plant. George Clark was chief erecting engineer for Westerlin and Campbell and George Schroeder was chief engineer for the Memphis Cold Storage Warehouse Co.

The equipment installed consisted of two York open A-column vertical ammonia compressors driven with cross-compound steam engines, two 650 hp Sterling Scotch Marine boilers with Burke smokeless dutch oven furnaces, and two General Electric Co. electric generators driven with vertical compound steam engines. After the plant installation had been completed and put in operation, Conley went to work for the Memphis Cold Storage Warehouse in September 1908. He was made chief engineer of the plant in 1918. In 1927, all of the original steam equipment was torn out, junked, and new equipment was installed. All equipment today is driven by electric motors. All new York compressors were installed.

"During all the years with the company," Conley related to the August 8 visitors, "I have seen many changes take place in the storage of products in cold storage plants. During the Fall and Winter months, the plant would be loaded with apples, oranges and grapes; Spring and Summer months, the plant would be loaded with cases of eggs.

Frozen Foods

"Frozen foods did not become popular in this section of the country for many years. I have seen the frozen food brought into the plant and when they tried to sell it and could not, it was finally shipped back to where it came from or given to some charitable institution. Today the company handles thousands of pounds — better say tons — of frozen foods daily, plus shell eggs, apples, oranges and grapes. In the early days, poultry, fish and sea foods were practically unknown. Today our plants handle tons of it.

"I don't have the words to describe the revolutionary and drastic design changes in the present day refrigeration equipment compared with plant designs during my 49 years with the company", Conley told the guests. However, IR reporters were quick to note that the older plant is now two stage, employing booster equipment and two suction levels, although the house itself is still refrigerated indirectly with brine. The new plant employs two stage compression as well, using rotaries for boosters, and liquid NH_3 recirculation for the freezers. No brine is used there.

Cites NAPRE in Memphis

When pressed for his own activities in NAPRE, Conley related: "I joined the association in 1910 but was not a Charter member. A local chapter was organized in Memphis in 1912, Tennessee No. 1. I am a Charter member of the Chapter. I have been Secretary-Treasurer of Tennessee No. 1 since 1916.

"Secretary-Treasurer is the only office I have held in the Chapter. In 1932, I was elected to the National Board of Directors and served as President of the National during 1938. Memphis (Tennessee Chapter No. 1) has the honor of more National Presidents than any other city or chapter: J. W. Marshall, James S. Spalding, Chas. A. Conley and Alvis J. Clay. Marshall and Spalding are deceased."

St. Louis Pipeline Service Discontinued

THE Merchants Refrigerating Co., has notified customers in St. Louis, Mo. that it will not renew present contracts for supplying piped ammonia for air-conditioning and refrigeration purposes to downtown office buildings, department stores, hotels, theaters, restaurants and other firms.

The service will be ended with the termination of existing contracts, a company spokesman said. Most of the contracts expire this fall, with the last to end next June.

The withdrawal of Merchants from this business means that its present customers will have to augment existing equipment to provide their own refrigerants after this year. The company has been furnishing ammonia to the various downtown buildings by underground pipe lines.

A check of major hotels and restaurants showed only one that will be affected immediately, Miss Hulling's Cafeterias. General manager Joe T. Swinburne said the firm will have to buy air-conditioning units for both stores and four walk-in and one reach-in refrigeration unit before its contract with Merchants expires May 1, 1957. He estimated the cost of the new equipment at approximately $54,000.

W. R. Hanebrink, manager of the pipe line, said the company was abandoning this service because construction of the Third Street interregional highway extension would require costly relocation of the ammonia pipe lines. The additional expense in relaying the lines under Broadway, Third and Fourth streets would not make continued operation of the service feasible, he said.

The refrigerant furnished by the firm was used not only for air-conditioning, but also for ice water and food refrigerators in hotels and restaurants. A large part of the business had been with produce dealers in the old Third Street commission row, now closed.

It will take about six months for the city to design and install facilities necessary to replace the service it now receives, it was stated. An extension of the contract will be requested until the new facilities are in operation.

Frozen Asparagus and Spinach Reach New High

THE 1956 pack of frozen asparagus amounts to an all-time high of 36,194,459 pounds, according to a preliminary survey by the National Association of Frozen Food Packers. This compares with the previous record pack of nearly thirty-three million pounds in 1953, and represents a 26 percent increase over last year's pack.

The spring pack of frozen spinach also soared to a new high of 81,442,535 pounds. This production total exceeded last year's record pack of nearly 66.9 million pounds by about 22 percent.

Regional production of asparagus departed considerably from the general pattern of the past few years. A slight increase in the Midwest pack was more than offset by a decrease in the East and South. Production in the West, principally in California, was responsible for the size of this year's pack. In recent years, the West accounted for 50 to 52 percent of the total pack, but the figure jumped to nearly 62 percent this year.

Regional production of spinach followed the traditional pattern of roughly one-third in the East and South and two-thirds in the West, Chiefly California. However a reversal of the trend was noted in that a somewhat greater precentage of the total pack was in the East and South this year, where production had showed a slight decline in recent years.

Ice Machine Impresses Visitor from Europe

A GIRL from Europe says she bets no one would guess the thing that struck her as most remarkable about her adopted country when she first arrived in New Mexico recently. She says it wasn't the number of automobiles. ("We don't have as many but bunched together in Little Germany, they look like as many")

And it wasn't the openness of desert country. ("It's so different from anything I'd ever seen that it doesn't even register.") And it wasn't any of the other things newcomers traditionally marvel at.

It was a little building just outside of Albuquerque on U.S-66. You put a coin in it and out comes a bag of ice. Right on your way to the woods you can stop, get ice for your drinks and go on your way. "That's what made the biggest impression on me, I think," she said.

The above was the "lead" to a publicity story in the Albuquerque N. M. Journal on the ice service available from the Albuquerque Ice Company. The story was furnished to newspapers by the Associated Press.

Magazine Article Boosts Ice for Cold Drinks

ICE CUBES are publicized in a three-page article in the August issue of Pageant, "That Nice Ice," by Arturo F. Gonzales. It leads off with a dissertation on the pleasures of having an ice-cold drink on a hot day: "During an August scorcher as cubes of ice nestle with a sparkle in your favorite drink . . . as gray-white mounds of its shavings frost your chilled fruit-cup . . . or a huge glistening chunk of it bathes in your party punch-bowl . . . ice can suddenly become the most important, delightful element in the universe."

The article then traces some of the eventful history of the ice industry.

Regal 25 SPECIAL PRICE $195.00

That's it — the Bateman Regal Model 25 — ideal platform sacking or paper bags, or general use — is yours now at the SPECIAL price of $195.00, with ¾-HP motor.

Strong and sturdy, this ever-dependable ice crusher stands on all steel frame and legs, with steel handle and grate. Self-aligning ball bearings assure smooth operation by direct drive. Entire unit is galvanized to prevent rust.

A convenient shelf provides accommodation for ice before entering the 12" x 10½" hopper. Hopper itself can be slanted for easy loading.

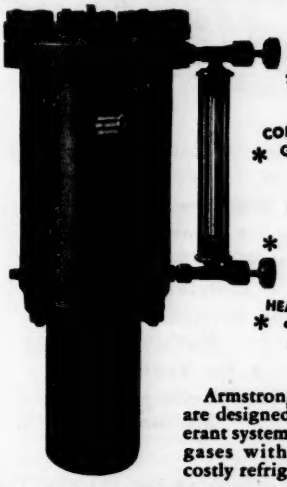
Four grate adjustments, effected by turning handle on side of the crusher, determine desired speed of grinding. Hopper accommodates long 50-lb. blocks and very fine ice can be ground with grate closed.

Two belts assure ample pulling power and are furnished with motor pulley when crusher order includes motor, or without motor. Protective guard covers both the flywheel and motor pulley.

Bateman Ice Processing Equipment

See Your Dealer
Mineral Wells, Texas

These People* have Profited . . . You Can Too!



5% GREATER CAPACITY, $250 MONTHLY POWER SAVING
* Planters Nut & Chocolate Company, Suffolk, Va.

COMPRESSOR CAPACITY RAISED 10%
* Gulf Oil Corporation wax plant, Philadelphia, Pa.

PURGER PAID FOR ITSELF IN 30 DAYS
* Dalton Ice Co., Dalton, Ga.

HEAD PRESSURE 50 LBS. LOWER
* on 90 ton ammonia system Mayo Hotel, Tulsa, Okla.

Armstrong Forged Steel Purgers are designed to *completely* rid refrigerant systems of all non-condensable gases without wasting a lot of costly refrigerant.

SEND FOR BULLETIN NO. 1921 — Contains complete information about the Armstrong Forged Steel Purger. Write:

ARMSTRONG MACHINE WORKS
860 Maple Street, Three Rivers, Mich.

ARMSTRONG FORGED STEEL PURGER
Satisfaction Guaranteed

Frozen Food Sales Increase

FROZEN FOOD distributors in the first six months of this year pushed their sales 11 percent ahead of 1955's first half, Richard M. Page, president of the National Frozen Food Distributors Association, said in a semi-annual report issued last week. More than 80 percent of the association's members reported sales gains.

Whether or not the distributors' sales increase accurately reflects overall national frozen food sales performance can't be determined now, Mr. Page explained. But he said volume of frozen meats and prepared foods probably is running more than 11 percent ahead of last year, while frozen vegetables, seafoods and juices are showing somewhat smaller sales gains.

In a general review of frozen foods trends, Mr. Page said frozen fruit volume is "running well ahead of last year" and sales prospects for frozen vegetables "during the remainder of the year and the first half of next year are excellent."

Prepared frozen foods "are now in an explosive growth stage" and their sales gain to date in 1956 probably is "large," he added.

Frozen orange juice sales in the first six months of this year "were only a little ahead" of 1955, in contrast to the 15 to 25 percent year-to-year gains of this product in earlier years. "Short crops" of Florida oranges in the past two years have "put a ceiling on the expansion of orange juice sales," he said.

Meat Packers to Push Packaged Frozen Meats

WITH meat packers, all the way from small local operators to regional and national processors, constantly adding to their lines of packaged, quick frozen meats, and hammering steadily on the "portion control" theme, the industry's selling pattern continues in the throes of a revolution.

Scarcely a day passes without the launching of some new package of flash-frozen meats in some part of the country. Now, Armour & Co., is kicking off a major operation in frozen packaged red meats. Armour's prepackaged line of flash-frozen steaks and other red meats is being introduced, city by city, beginning with Cleveland. The company's plans call for opening up other markets at the rate of two per month.

The new Armour line, initially, will be made up of beef sirloin strip steaks; top sirloin beef steak; chopped beef round steaks, with butter added; boneless beef for stem, and loin lamb chops. Scheduled for addition to the new line shortly are boneless pork chops and veal cutlets.

The packaging of the new line highlights life-size, exact color reproductions of the uncooked meat cuts on the top of the carton, with the reverse side carrying cooking instructions and an illustrated serving suggestion in full color. The cuts are to be cooked directly from the frozen state. Packages vary in size, to conform to their contents, but all are of basic rectangular form for easy stack-in, and bear Armour's "Star Brand" design.

The frozen meats are protected by three separate materials. The cuts are first sealed in a close-adhering transparent plastic film after the air has been removed. They are then placed in a firm cardboard carton, which is overwrapped with heat-sealed waxed paper.

The company's entry into the packaged frozen red meat field, D. B. Love, Armour's frosted meats division manager, emphasizes, is just one phase of a long-range program.

LOWER YOUR COSTS
BALLARD ENGINEERED
ESKIMO EQUIPMENT
• Ice Processing, Handling & Bagging Equipment
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WRITE FOR CATALOG or— Phone Fort Worth ED 2-3216
COMPLETE SUPPLIERS TO THE ICE INDUSTRY
"One Call For All"
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CONDENSER WATER DISTRIBUTORS

(Spiral Non-Clogging Type)

WIN the Approval of Engineers in Countries Throughout the World.
ASSURE . . . . Reduced Ammonia Head Pressures.
Eliminate . . . . Constant Cleaning of Distributors.

Enthusiastic users maintaining lowest ammonia discharge pressures on vertical shell and tube condensers are amazed at the large amount of water — and the substantial money they save.

MORE THAN TWO MILLIONS IN ACTUAL OPERATION
Save 4 to 6 Hours Freezing Time

American Ice Mach. & Equip. Co.
1522 Orthodox Street **Philadelphia 24, Pa.**

Refrigeration Machinery Industry Shows Gain

(*Continued from page* 20)

sisting of electric appliances, pumps and compressors, aircraft parts and ordnance.

The general statistics (employment, payrolls, cost of materials, etc.) are reported for each establishment as a whole. Aggregates of such data for an industry reflect not only the primary activities of the establishments in that industry, but also their activities in the manufacture of secondary products and receipts for their other activities (contract work on materials owned by others, repair work, etc.). This fact should be taken into account in comparing industry statistics (Tables 1 and 2) with product statistics.

More detailed figures for this industry will appear in the Census Bulletin, MC-35F, "Service-Industry and Household Machines," which will be published and offered for sale at a later date by the Superintendent of Documents, U. S. Government Printing Office. Also, in this bulletin, there will be a comprehensive discussion of such concepts as "industry," "establishment," "secondary production," as well as the various statistical items such as "employment," "value added," etc. The 1954 Census of Manufactures is the twenty-sixth such census of the United States since 1809. For 1954, it was conducted jointly with the Censuses of Business (Wholesale, Retail, and Services) and Mineral Industries, covering continental United States, Alaska, and Hawaii. Present legislation provides for a Census of Manufactures every five years, with the next one scheduled to cover 1958. In addition, the law authorizes annual sample surveys to be conducted in interim years.

Pacific Fruit Express Adds Refrigerator Cars

A CONTRACT to provide 100 refrigeration systems for Pacific Fruit Express Company railroad cars has been announced by Laurence Hogan, sales manager of transportation equipment for Carrier Corporation. Installation of the units will be completed in January, 1957.

The new systems are all-purpose in that they heat as well as cool providing for constant temperature despite outside changes of climate usually encountered in transcontinental runs. Refrigerating capacity is capable of reducing the car temperature to well below usual requirements. A temperature range from minus 10 to 70 F is possible, depending on the thermostat setting.

The units are designed to "think by themselves" as they are unattended for as long as 14 days on a cross-country trip. Defrosting is automatic with the electric heater tripped into action when the cooling coils become frosted enough to hamper the flow of air.

Warehouse Directory Available to Customers

THE National Association of Refrigerated Warehouses has hit the "best-seller" lists in the perishable food industry with its current Annual Directory of Public Refrigerated Warehouses. The 1956 Directory has proved itself one of the most popular reference books in the industry. Although increasing demands for the Directory have depleted supplies considerably, there are still some of these books available for customers of public refrigerated warehousemen, customer associations and their members—at no charge. Requests will be filled as long as the supply of books lasts. Requests for copies of this Directory should be directed to NARW.

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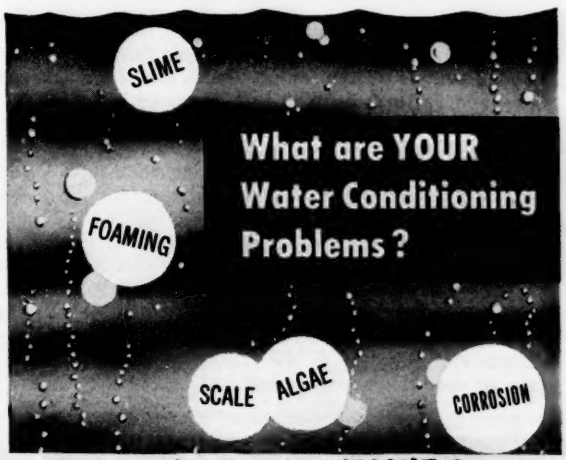
WELDED — RIVETED ICE CAN GRIDS

Industrial Trucks and Trailers

THE OHIO GALVANIZING & MFG. CO.
NILES · · Established 1902 · · OHIO



Be Sure You Get the WRIGHT Answer

Because water conditioning problems are individual, no one "cure-all" solves them all. The Wright method discovers *which* detrimental factors are characteristic of your water system and treats the specific condition. Wright Service provides a study of *your* water problem, a laboratory analysis is made, a written proposal gives recommendations for the solution, then frequnt checks are made to assure continued efficient performance. There is no guess or experiment. Write or call us today for a survey of *your* water conditioning problems. No obligation.

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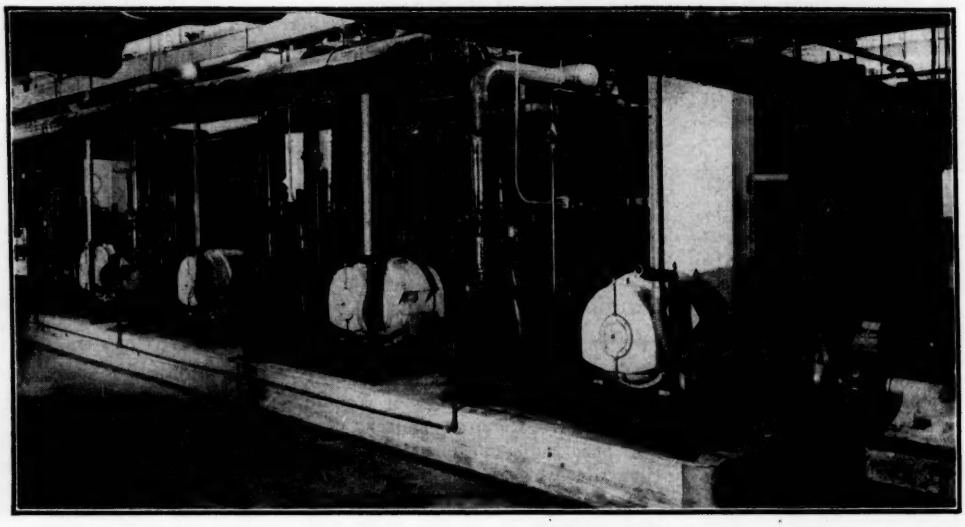
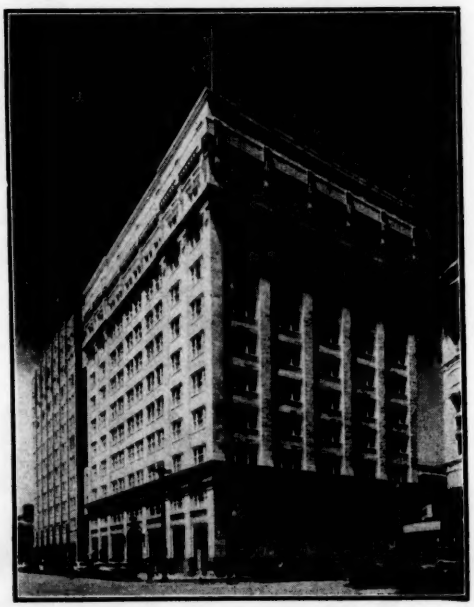
Offices in Principal Cities
• Softeners, Filters and other external Treating Equipment
• Nelson Chemical Proportioning Pumps

Buildings for Galveston Insurance Company Air Conditioned



Above: These nine cylinder compressors on individual bases furnish 75 horsepower for the air conditioning system of the American National Insurance Company. Shell vessels and pumps between two rows gives flexibility, efficiency, easy maintenance and low starting current. The building at the right houses the offices of the company, with more than 1,000 employees and is joined by two "bridges" to the annex.



AIR conditioning equipment has been installed in the two large buildings of the American National Insurance Company, Galveston, Texas. The company has branch offices throughout the United States, and has over $3 billion of insurance in force. The two large buildings are each eleven stories high.

The refrigeration load is carried by eight "Eclipse" compressors, each with nine cylinders. These machines operate at 660 rpm, being driven through V-belts by motors of 75 horsepower. The machines are placed on concrete bases, with cork isolation, in two rows, and between these rows are mounted the condensers and water coolers, the shells of which can be partly seen in the picture.

The American National was founded by W. L. Moody Jr., in 1905. The Moody's daughter, Mary M. Northern now president of the company, takes an active interest in all its affairs. Joe E. Hood, assistant vice-president of the company, supervised the installation of the air conditioning equipment.

new KRACK air cooled condenser

Now available in capacities up to 30 tons.
No need to use an oversize condenser.
Special features

1. Rust resistant
2. Semi-automatic belt adjustment
3. Counter-flow refrigerant circuiting
4. Minimum maintenance
5. Multi-circuiting at no extra cost

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901 West Lake St., Chicago 7, Ill.
MOnroe 6-1141

Pioneers in Refrigeration and Air Conditioning Since 1931

Temperature Tolerance Study of Frozen Foods

(*Continued from page* 3)

aggressive vigor and with attainment of the practical objectives. Comparatively few people handle frozen foods at the beginning of their career from producer to consumer. In the course of that journey, however, thousands and eventually millions will handle them. The problem is to impress these technical facts on the minds of these thousands of handlers. That job must be undertaken without technical language, but rather with clear and forceful means of every kind available.

No doubt, many who handle frozen foods have had the experience of finding packages thawed, refreezing them, and finding them still salable. Those people will be hard to educate. The earliest and fastest changes in quality that take place, the changes in flavor, color and texture, are apparent only to those who have studied quality carefully. Once damaged slightly by temperature and then returned to zero or lower, the food retains the damage, and an additional experience at a temperature at which the rate of change accelerates will only carry the damage further. The consumer will have less of the original high quality because careless handling along the way has used up too much of it!

Russia to Buy Fishstick Equipment from Canada

RUSSIA will buy refrigeration equipment, fishstick making equipment and some packaging machinery from Canada. The announcement was made at Ottawa by Russia's Fisheries Minister Alexander A. Ishkov who is half-way through his cross-country tour. He said members of his delegation had given specifications of what they want to John Inglis technicians with whom they huddled at Niagara Falls.

Just what and how much of it will go to Russia wasn't revealed. Both Mr. Ishkov and Canada's Minister of Fisheries, James Sinclair, who is acting as a sort of national guide in return for Russian escorting on this trip there last year, declined to estimate quantities and costs.

Mr. Ishkov said he had been impressed with the equipment at post-Confederation plants in Newfoundland. He said Russia wouldn't buy samples to be copied provided Canadian quantities and prices were right.

Refrigeration equipment is a "must" in Russia. "Much of the catch is far from the market. In fact, the fishing grounds themselves are generally so far from shore, the catch must be processed at sea.

Cold Storage of Strawberry Plants

IMPORTANT information on the storage of strawberry plants has become available. Sources are University of California, College of Agriculture, at Davis and USDA.

Storage temperature should be about 30 F. — definitely not above freezing for any length of time. Only mature, dormant plants should be stored. Packing should be good enough to avoid drying. The plants become encased in ice, but they are not damaged. At present, researchers do not know just where the point of damage from temperatures below 28 F will be, but there is some evidence that even at 28 F., the result is slower starting and fewer runners as compared with 30 F. USDA Research men have reported also that cold storage (32 F for two weeks) has enabled strawberry plants to withstand a 2-minute dip in water at 127 F.

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AMMONIA

Anhydrous Ammonia

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OF SERVICE
IN CHEMICALS
1855 - 1956

PROMPT SHIPMENTS AND PURITY OF PRODUCT ARE TWO GOOD REASONS FOR SPECIFYING BOWER BRAND

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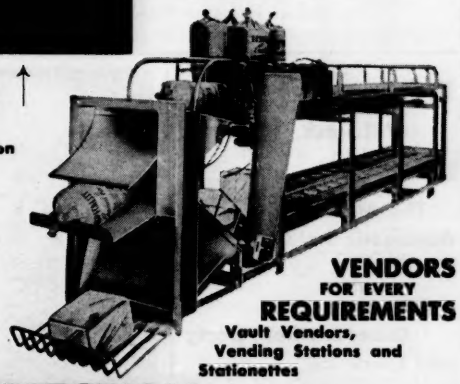
Ice-A-Teria Bagger-Weigher

MODEL 150-B

Designed for fast operation, the twin spouts let the operator remove one bag and replace with an empty. The second bag on the weighing platform has filled, the weight has stopped the machine. The minute the operator removes the filled bag, the scales move upward and starts the mechanism filling the second bag. The operator has only to move the flap in the dividing head the second he has installed the empty bag, this must be done before removal of full bag.

See this new Machine at the Convention



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COMING CONVENTIONS

FLORIDA ICE ASSOCIATION
October 14-16, 1956
Suwannee Hotel, St. Petersburg, Fla.
Muriel Washburn, Exec-Secy.

CANADIAN ASSOCIATION OF ICE INDUSTRIES
October 15-17, 1956
The Chantecler Hotel, Ste. Adele, Quebec
Mrs. Mildred Croft, Secretary

NATIONAL ASSOCIATION
PRACTICAL REFRIGERATING ENGINEERS, INC.
October 29-November 2, 1956
Statler Hotel, Detroit, Mich.
J. R. Kelahan, Secretary

NATIONAL ASSOCIATION OF ICE INDUSTRIES
November 13-16, 1956
Atlanta Biltmore Hotel, Atlanta, Ga.
Guy W. Jacobs, Secretary

SOUTHWESTERN ICE MANUFACTURERS ASSN.
November 25-27, 1956
Adolphus Hotel, Dallas, Texas
Gen. P. A. Weatherred, Secretary

NATIONAL POWER SHOW
November 26-30, 1956
New York Coliseum, New York

DELTA STATES ICE ASSOCIATION
December 2-4, 1956
Arlington Hotel, Hot Springs, Ark.
Mrs. Edna Vaughan, Secretary

CHICAGO DISTRICT ICE ASSOCIATION
December 12, 1956
Drake Hotel, Chicago, Ill.
Wm. Strauss, Secretary

NATIONAL ASSOCIATION FROZEN FOOD PACKERS
January 6-10, 1957
Fountainbleau - Eden Roc Hotels, Miami Beach, Fla.
Lawrence S. Martin, Secretary-Manager

INTERNATIONAL HEATING AND AIR CONDITIONING EXPOSITION
February 25 - March 1, 1957
International Amphitheatre, Chicago, Ill.

AMERICAN WAREHOUSEMENS ASSOCIATION
April 1-5, 1957
Chalfonte-Haddon Hotel, Atlantic City, N. J.
Wm. Dalton, Secretary

NATIONAL ASSOCIATION REFRIGERATED WAREHOUSES
April 1-5, 1957
Chalfonte-Haddon Hotel, Atlantic City, N. J.
Wm. Dalton, Executive Vice-President

Toughness in Frozen Birds Aged for Various Times

THE POULTRY industry has been confronted with increasing numbers of complaints of toughness of frozen birds that were otherwise young prime turkeys or chickens. This was reported in a paper at the 44th Annual Meeting of The Poultry Science Association. The paper was prepared by A. A. Klose, Helen L. Hanson, M. F. Pool, and Hans Lineweaver.

It is well known that tenderness develops rapidly in poultry as compared to beef, and the normal course of commercial processing has been considered adequate to permit tenderization to occur. Recent tests, however, have shown that birds cooked from the frozen state or cooked promptly after defrosting may not be adequately tender. Degree of toughness decreased markedly during the first ten hours after slaughter and less markedly during the next ten hours. Test birds cooked from the frozen state by roasting and by deep-fat frying. The pectoralis major muscle was more than four times as tough (shear-force measurements) for turkey fryer-roasters frozen one or two hours after killing as for birds frozen 20 hours after killing.

While the rate of tenderization is reported to be greatly decreased or arrested by freezing, it continues after thawing at a rate similar to the original. Results indicate that the three to six hours that generally elapse between killing and freezing will frequently not be sufficient to assure tender birds if cooking is from the frozen state.

Specification of required aging times is expected to depend on a number of factors including plant operating procedure, cost of holding operation, and definition of adequate tenderness as well as age of bird, species, and product form.

Citrus Fruit Storage

SOME interesting results are appearing in storage tests by the United States Dept. of Agriculture at Orlando, Fla., conducted by Dr. Paul Harding on Marsh grapefruit. An initial period at 50 F followed by a later period at 40 or 32 F and a final period of a week at 70 F showed only about one percent of pitting. Since pitting develops freely at 40 F these results are unusual. Of 15 treatments the least decay occurred in the lot held a week at 50 F plus seven weeks at 32 F plus a week at 70 F.

From the tests in Texas, H. B. Johnson has reported no difference in keeping quality of grapefruit from the upper, middle and lower section of the Rio Grande Valley. At 50 F decay was not a problem, regardless of harvest date. Pitting was more severe in fruit harvested early and stored at 40 F.—TRRF Information Bulletin.

K. G. Brown Mfg. Co., Inc.
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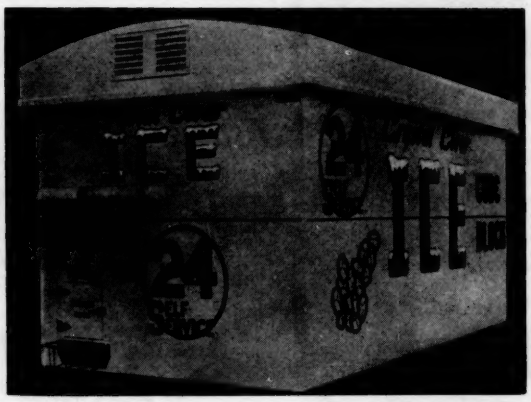
PRESENTS:

The Most Modern Automatic Ice Cube Vendor.

- **Dispenses Cube, crushed, party and block ice**
- **Ready for immediate operation.**



The 8' x 16' station pictured here, vends 135 10-lb. bags & 60 25-lb. blocks

The new low-cost 6' x 8' station vends more than 85 ten-lb. bags.

Write today for complete details on this Double Unit and other sizes and models.

Ice Vending Machine Delivers Boy

AN ICE vending machine at Harrisburg, Pa., delivered to a surprised customer a bonus of one slightly-chilled ten year old boy. The boy told police he had climbed into the machine to pilfer the coin box. When the customer dropped a coin in the slot, the boy came out of the chute with a 50-cent bag of ice. "I was never so scared in my life," he reported. Aside from being thoroughly refrigerated, he was reported to have suffered no ill effects.

News of PEOPLE

ROBERT B. WESTON vice-president and service manager of Weston Sales & Service Company, Pittsburgh, Pa., has been elected chairman of the Pittsburgh Section of the American Society of Refrigerating Engineers. Other new officers are Charles Goodman, Pennsylvania Power Co., vice-chairman; Williman C. Yocum, Superior Valve & Fittings Co., secretary and John P. Michaels, Pennsylvania Industrial Supplies Co., treasurer.

DEATHS

Wm. L. Bankston

Wm. L. Bankston

THE death of W. L. Bankston of Birmingham, Alabama, occurred suddenly Sunday, August 5, following a heart attack. Mr. Bankston was widely known throughout the southwestern states which he had covered for over fourteen years as sales representative for the Chemical Solvent Company, Birmingham.

Born and educated in Georgia, Mr. Bankston had lived in Birmingham for the past 35 years where he had taken an active part in civic and club affairs. Among his many organization memberships were Delta States Ice Association and Refrigeration Service Engineers Society. Mr. Bankston will be sorely missed by his many friends and fellow associates.

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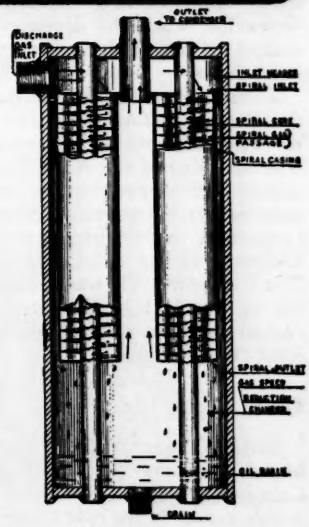
"KING ZEERO" OIL SEPARATOR

Stops oil from entering condenser receiver and low side

Allows operation as originally intended. Simple in operation — no parts to wear out — no screens, metal wool or any close screens to clog, raise discharge pressures and cut down capacity.

When used in connection with air compressors, water is also separated with the oil.

Made in 12 sizes, ½" to 6".



Built for years of trouble free service. Mechanical details on request.

THE KING ZEERO COMPANY
4300-14 W. Montrose Ave., Chicago 41, Ill.

He is survived by his widow, Mrs. Jeannette Young Bankston, of Birmingham, and one sister, Mrs. G. C. McGee, of Roberta, Georgia.

Charles F. Belshaw

THE DEATH of Charles F. Belshaw, well known throughout the ice and related industries, occurred at his home in Greenville, Mich. July 24 after a six months illness, at the age of 63 years.

Mr. Belshaw was best known for his inventive turn of mind in refrigeration and refrigerator mechanics. Among other things he put forth the idea of selling crushed and sized ice, years before the ice industry was ready for it. In this connection he had a model household refrigerator designed for the use of crushed ice. He also did pioneer work in fresh vegetable icing in retail produce stores.

He was a graduate of the University of Illinois in mechanical engineering and served in World War I as a Lieutenant of army engineers. Back in civilian life he served in an engineering capacity for various concerns, including the George B. Bright Company where he directed test procedures on domestic refrigerators, both ice and mechanical, and later as chief engineer for the Coolerator Corp., Duluth, Minn. and engineering and sales for the Ranney Refrigerator Company, Greenville, Mich. Since 1936 he had conducted his own business as the Belshaw Manufacturing Company, Greenville, where he developed specialties in the refrigeration and related fields.

For two years he was secretary of the Detroit Section, American Society of Refrigerating Engineers and was chairman of the A S R E refrigerator test procedure. He was a member of the American Standards Committee on Refrigeration and Chairman of the Sub-Committee on Test Procedures. He was a life member of the AS R E and an affiliate charter member of the Institute of Food Technologists.

Geo. W. Ashlock

GEO. W. ASHLOCK, at one time branch manager of Westerlin and Campbell Fort Wayne office, and widely known in the cold storage and refrigerated warehouse field, and among the Midwestern dairy and ice cream manufacturing firms, passed away on August 11. He was employed as a sales engineer by Westerlin & Campbell Corp. (now the York Corp. Central District Office) from July 1928 until his retirement in 1954. He was given a 25-year citation by that firm shortly before he suffered a paralytic stroke which brought about his retirement. He was 58 years old, having been born on March 24, 1898.

He joined ASRE in 1946 and was a member of the Chicago Section until he suffered a stroke two years ago. He is survived by his widow, Alma Ashlock, four children, George S., Robert T., Mrs. Mary Jane Johnson and Mrs. June Pavlik; by his mother, Mrs. Lucy Ashlock, brothers Carl J. and Frank J. Services were held at chapel, 5501 N. Ashland Av. on Tuesday, August 14, 2 P.M. and interment Acacia Park. He was a member of Medinah temple and Ancient Accepted Scottish Rite of the Masonic Order.

WILLIAM H. WILLIAMSON, retired vice-president of the Cataract Ice Company, Niagara Falls, N. Y. died at his home in Niagara Falls, August 21 of a heart attack. He was 82. Surviving are two sons, Richard P. Williamson and William H. Williamson Jr., and a daughter Mary Elizabeth Williamson.

MANUFACTURERS' NEWS

Yorkco Research Pays Off

RESEARCH and development at the York Division of Borg-Warner are carving for York a larger slice of outstanding sales from the potential in refrigeration and air conditioning, according to a statement issued by S. E. Lauer, president and chief executive officer of the division.

In reporting a record volume in large and important contracts, during the past few months with an aggregate capacity of approximately 35,000 horsepower and sales value in excess of $6-million, Lauer pointed out that York's recently developed "turbomatic" compressor was an important consideration in a large number of these projects.

Lauer described this compressor, available in capacities of one hundred through six hundred horsepower, as a development of York's engineers which encompasses an entirely new concept in design. Its simplicity provides ease of operation and installation, and a minimum in maintenance, for it contains only 300 parts, compared with 1100 in a previous design. Its light weight of only 1600 pounds, compared with a weight of 7600 pounds for a compressor of equal capacity in an earlier design, makes it particularly adaptable to upper floor installations, a requirement that is being encountered with greater frequency in providing air conditioning for existing multi-story buildings.

Lauer stated, also, that York's new cooling systems using the turbomatic compressor is the closest approach to a hermetically sealed system of any centrifugal compressor on the market with the flexibility, also of being driven by any type of prime mover — electric motor, steam or gas turbine.

To show its great acceptability and versatility of application, Lauer went on to mention that the York turbomatic was selected for the fifth super carrier under construction by the New York Ship Building and Dry Dock Company for the U. S. Navy, that eight of them will be installed on escort vessels for the Canadian Navy, and that it has been selected for a number of large and varied installations over the past few months, among them the Provident Trust Company of Philadelphia; the Tishman Realty Company of New York; the Potomac Parkway Apartments, Washington, D. C.; the National Broadcasting Company, New York City; St. Mary's Hospital and the Municipal Court Building; St. Louis, Missouri, and for a public building in Colonial Williamsburg, Virginia.

Lauer pointed out, also, as an indication of the numerous and broad markets for refrigeration and air conditioning, that this list of outstanding sales included such names as Ford Motor Company, General Motors, Pratt & Whitney, Food Fair, Sylvania Products Corporation, International Business Machines, the Empire State Building, and the Great Atlantic & Pacific Tea Company, among York's customers.

Clark Door Company Expands Production

James Harris

THE CLARK Door Company, Newark, N. J. has announced plans for expansion of the company's activities. The Clark organization, entered the cold storage door field in 1954 with its Prest-O-Matic units. According to Henry B. Clark, president, these have achieved wide acceptance in the frozen food industry from packers, distributors, warehouses and food chains. Installations in all segments of the frozen food industry over the past 18 months have shown the economy and efficiency of automatic door operation.

Alterations to the Clark plant will add approximately 5000 square feet to production facilities and also provide for additional office space. One area, formerly used for storage of parts and supplies, has been converted to the manufacture of electric door operators and special facilities will

be available for the insulation of cold storage doors with polyurethane foamed-in-place insulation. The Clark company pioneered the use of this type of insulation for door construction.

Mr. Clark also announced the appointment of James H. Harris Jr. as vice-president in charge of sales. Mr. Harris, who joined the Clark staff in 1953 as sales manager, will be responsible for the development of an expanded organization for the sale and distribution of cold storage doors. In addition he will continue to direct sales activities for the company's automatic industrial doors and electric fire door operators.

Miner Laboratories

MINER Laboratories, a Midwest Division of Arthur D. Little, Inc., was opened in Chicago August 1. The announcement stated that this firm, which pioneered in ultra-low temperature test equipment and cryogenics makes all ADL research and consulting services now directly available to the midwest industry. Dr. C. S. Miner, Jr., is technical director of the new division and John R. Kirkpatrick is manager. The office and laboratory are located at 9 South Clinton Street, Chicago 6, Illinois. The parent firm is located in Cambridge, Mass. Some of the work of the Aruthr D. Little firm was reported in INDUSTRIAL REFRIGERATION in April 1956, page 27, entitled Industrial Test Refrigerators Improved.

Borg-Warner Names McCall

Donald McCall

DONALD A. MCCALL, director, community relations, York Division, Borg-Warner Corporation, has been promoted to the position of staff assistant in the management training and educational services department of Borg-Warner Corporation, Chicago. Announcement of the promotion was made by Mr. S. E. Lauer, President and Chief Executive Officer of Borg-Warner's York Division.

Fiberglas to Display at NAPRE Convention

LOW temperature insulations will be exhibited by Owens-Corning Fiberglas at the convention of the National Association of Practical Refrigerating Engineers to be held in Detroit, October 29 through November 2, at the Hotel Statler. Company representatives will be available to explain various methods of application. On display will be asphalt-enclosed board for walls and ceilings, asphalt-enclosed flooring and pre-formed dry wall insulations for walls and ceilings as well as various Fiberglas reinforced plastics.

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Equipped with HERMETICALLY SEALED Mercury Contacts

TO "MAKE" OR "BREAK" AN ELECTRICAL CIRCUIT ON CHANGES IN THE DIFFERENCE BETWEEN TWO PRESSURES

← FOR HIGH PRESSURES
Bourdon Tube Operated

Series BB: Operating ranges from 0-60 psi to 2,500 psi., with sensitivities varying from 0.4" to 50 psi.

Write for bulletin No. 15

← FOR LOW PRESSURES
Diaphragm Operated

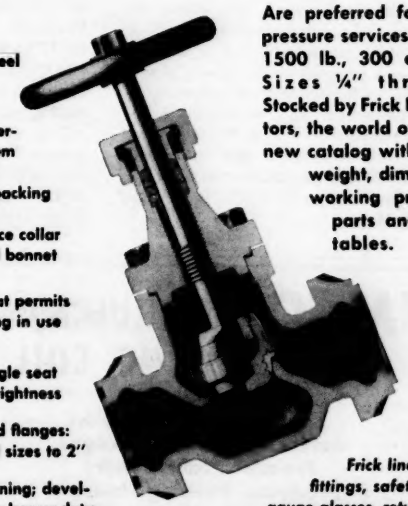
Extremely sensitive, for air or gas. Series PQ: Operating ranges (inches of water) 6.0" vac. to 6.0" press. (sensitivity .03",) and 30.0" vac. to 30.0" press. (sensitivity 0.1" to 0.02").

Write for Bulletin No. 14

THE MERCOID CORPORATION
4201 Belmont Avenue, Chicago 41, Illinois

FRICK

High-pressure Valves & Fittings



Large handwheel

Long oversized stem

Ample packing

One-piece collar box and bonnet

Back seat permits repacking in use

High-angle seat insures tightness

Standard flanges: screwed sizes to 2"

Full opening; developed for heavy duty

Are preferred for high-pressure services, 300 to 1500 lb., 300 degrees. Sizes ¼" thru 14". Stocked by Frick Distributors, the world over. Get new catalog with prices, weight, dimensions, working pressures, parts and useful tables.

Frick line includes fittings, safety valves, gauge glasses, return bends, manifolds and welded work.

WAYNESBORO, PENNA., U.S.A.
FRICK CO.

CATALOGS AND BULLETINS

Water Chiller Catalog

A NEW 16-page 8-½ x 11 two-color illustrated catalog (Bulletin 5925) describing Type CC packaged water chillers for air conditioning or industrial cooling applications is now available from American Blower Corporation, Detroit, Mich.

The new catalog describes the mechanical specification for all sub-assemblies and components in the Type CC units. Chiller element construction details are discussed; a cutaway view of this element is included to simplify understanding of the construction features. The major advantages to the user of completely packaged and tested water chillers are also outlined.

A recommended selection procedure is presented in the new catalog. A selection example is included to demonstrate the procedure. Seven pages of selection tables give sufficient data to permit proper water chiller selection for any requirement within the operating range of the Type CC units. An installation type drawing is also included which gives complete envelope dimensions for the full line of Type CC water chillers. A typical engineering specification sheet is offered in the new catalog as an aid to engineers, contractors or architects responsible for the specification of water chiller equipment.

Cryogenics Bibliography

SUPPLEMENT No. 8 to a low temperature bibliography from the field of Cryogenics was published in August by the Mechanical Division of Arthur D. Little, Inc. This supplements an original 63-page bibliography published in October 1952. It is a compilation of reports issued after 1944 on low-temperature physics, including theoretical and experimental research at temperatures of 20 K and below, together with techniques and equipment applicable to this region. Copies may be obtained from Arthur D. Little, Inc., Cambridge 12, Mass.

Bulletin Offered

AIR purification and air recovery are covered in a bulletin recently announced by the Cameron Norkem Inc., of Yakima, Wash. The bulletin contains information on air contamination and its recovery; covers methods, installations and capacity of air recovery systems; and, details the service of catalytic carbon cells for this purpose. Specifications covering factory manufactured filter cells are also included. Cameron-Norkem cites references in this booklet, one of them being the article "Air Recovery for Economical Air Conditioning" by Homer M. Bird, INDUSTRIAL REFRIGERATION, September 1954, Page 21.

Folder on Fittings

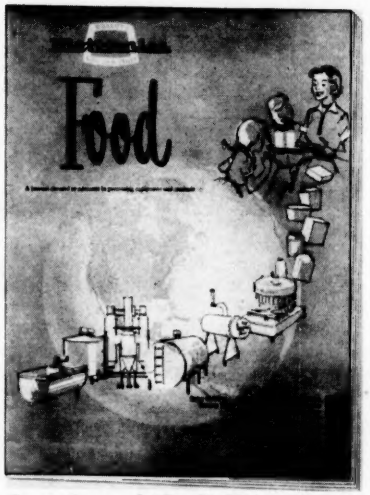
A NEW six-page folder has been released by the Tubular Products Division, fittings department, of The Babcock & Wilcox Company, Beaver Falls, Pa. This folder, identified as FB-502, describes briefly but completely the full line of carbon, alloy and stainless steel seamless welding fittings and forged steel flanges handled by B&W. Engineers, buyers, and estimators whose duties require them to be familiar with the various types and sizes of welding fittings and flanges will be interested in this catalog.

Henry Parts Catalog

COMPLETE Parts Catalogs covering Henry Products have been released by the Henry Valve Company, Melrose Park, Ill. Parts Catalog FPL-11, consists of 32 pages of detailed cross-sections and parts, together with list prices, covering Henry Freon valves and accessories, including packless and packed valves, check valves, strainers, driers and liquid level gauges for refrigeration, air conditioning and industrial application. Parts catalog APL-11 is a 24 page booklet covering Henry Ammonia Valves and Accessories.

House Organ Tells About Food Processing

A NEW issue of "Food", the feature house organ, published regularly by Mojonnier Bros. Co., Chicago, manufacturers of dairy and food processing equipment, is now available to readers. it highlights a number of interesting, informative case histories of plants which profitably



Front Cover of "Food" Mojonnier Bros. House Organ.

solved problems of processing and product handling. Featured in its twenty, well illustrated pages, are new, advanced processing techniques, methods and equipment, designed to lower costs and improve production.

Industrial Cooling Tower Catalog

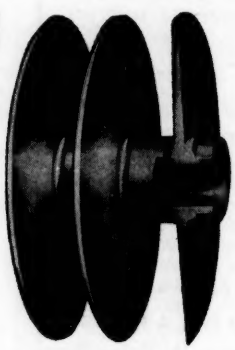
AN EIGHT-PAGE catalog on the new "MTI" line of industrial cooling towers has been issued by the Baltimore Air Coil Co., Baltimore, Md. The new cooling tower is designed especially for industrial applications where process water temperatures are critical and must be accurately maintained. The units have a capacity safety factor to guarantee positive performance at any condition. The catalog describes in detail the 44 sizes available, and gives complete selection data.

DIMCO CAST ALUMINUM FIN EVAPORATING COIL

The Ideal Refrigeration Surface for Cold Storages, Freezer Plants, Dairy Products, Packing Houses, Abattoirs, Breweries and numerous applications

DETROIT ICE MACHINE COMPANY

2615 Twelfth St., Detroit 16, Mich.



★ *Saves Space*

★ *Saves Weight*

★ *Saves Cost*

CAN BE USED WITH ANY REFRIGERANT

Write For Descriptive Folder

Send for case histories on how
WATKINS
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(patented)
CUTS REFRIGERATION COSTS

● The Watkins Liquid Recirculator allows you FULL USE, full advantage of your evaporating coils.

It allows continuous FULL FLOODING in complete safety — is designed to catch excessive slop-over. This assures top efficiency. You use every square inch of evaporating area in the coils, bottom to top.

You save power, reduce maintenance costs. Even first cost of the Recirculator is less than that of a mechanical pump, which it replaces.

SEND FOR FACTS

The J. E. Watkins Co.

Manufacturers of: LIQUID RECIRCULATORS • EVAPORATIVE CONDENSERS • LIQUID PRESSURIZERS • INTERCOOLERS • FLASH GAS ECONOMIZERS • HOT GAS DEFROST SYSTEMS • RECEIVERS • PURGERS • LIQUID CHILLERS
Dept. 5
307 Lake St., Maywood, Ill.—FI 5-0111

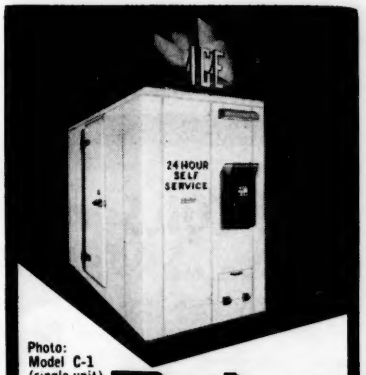


Photo: Model C-1 (single unit)

Perlan

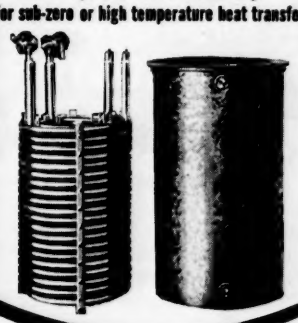
Automatic Ice Vendors Sell handy bags of cubed or crushed ice.

Write today for prices and details on complete line of ice vending equipment. Dept. I-10.

REFRIGERATION ENGINEERING COMPANY
MONTGOMERY, MINNESOTA

ECONOMIZE! STANDARDIZE!
on "Rempe"
PIPE BENDS AND COILS FOR REFRIGERATION

Rempe Shell and Coil Assembly for sub-zero or high temperature heat transfer.



In Rempe Coils you get Top Engineering and Quality Construction — the best in Refrigeration Equipment for long-life and low maintenance. For Ammonia or Freon. All materials — Stainless Steel, Copper, Steel.

REMPE COMPANY
348 N. Sacramento Blvd., Chicago 12, Ill.

Classified Advertising

All classified advertisements are payable in advance. Except for Positions and Help Wanted classifications, this section is reserved exclusively for USED equipment.

RATES: 20c per word; minimum 25 words. $2.00 per line for bold face headings: $15.00 per inch for line listings.

Positions and Help Wanted

WANTED

A man experienced in the ice industry to manage the supply and equipment department of a prominent manufacturer of processed ice equipment and supplies. Excellent opportunity for right party. Give qualifications in first letter. Write Box OT-9, c/o Industrial Refrigeration.

HAVE PERMANENT, YEAR-ROUND POSITION
For good, industrious ice plant engineer and maintenance mechanic; capable of making necessary repairs, upkeep and operating and 8-hour shift when necessary. Plant is 350 ton, all electric full-row pull, at large icing station. Company paid hospitalization including family, and life insurance. Excellent opportunity for capable man. Mutual Ice Company, P.O. Box 669, Alexandria, Virginia.

USED EQUIPMENT—wanted & for sale

FOR SALE: Two 12¼x14½, 2 cylinder York ammonia compressors; one direct connected to 150 h.p., 164 r.p.m., synchronous motor with G.E. push button controlier, 440V; one direct connected to 175 h.p., 180 r.p.m., synchronous motor with G.E. push button controller 440V. Machines used to make 100 tons of ice daily. Look at these machines and make offer. New Orleans Cold Storage & Warehouse Co., Ltd. 305 Gaiennie St., New Orleans 13, La.

FINNED PIPE FOR SALE—48 lengths 12′ each Made from 2″ steel pipe-7″ square fins 1½″ apart; galvanized. New at only $3.00 per foot. Also 100 steel Hand Trucks. Medium duty; roller bearing wheels. New at $6.00 each. West Side Cold Storage Co., 7 Harrison St., New York 13, N.Y.

FOR SALE — Refrigeration equipment; ice equipment; new, used. Advise us your needs. Use "QUICKSEAL" — stops brine tank leaks; easy, efficient, economical. Born Company, 80 East Jackson Boulevard, Chicago 4, Illinois, WAbash 2-3299

FOR SALE—35 ton ice plant and cold storage; located in growing mid-western community. Brick building near center of town. No competition; money maker. Reason for selling, wish to retire. Write Box OT-8, c/o Industrial Refrigeration.

FOR SALE—Platform skids — good used, hardwood; 36″ x 60″; welded steel frame; 7½″ welded legs — $4.50 each while they last. Great Lakes Terminal Warehouse Co., 321-359 Morris St., Toledo 4, Ohio.

FOR SALE—AMMONIA—FREON
1—3-¾x3″—8 cyl. V/W York belt driven ammonia compressor.
1—5¼″x4¼″—6 cyl. V/W York ammonia booster comp.
1—6-¾″x5″—6 cyl. V/W York booster ammonia comp.
1—25 ton Chrysler Air Temp. Freon condensing unit, complete.
1—40 ton General Electric Freon condensing unit, complete.
1—50 ton General Electric Freon condensing unit, complete.
1—50 ton Buffalo Freon evaporative condenser.
ENTERPRISE EQUIPMENT CORPORATION
79 Alexander St. Yonkers, N.Y.
Cable: ENEQCO Phone Yonkers 8-8118-9

USED EQUIPMENT—continued

WANTED—Used ice plants, all sizes and makes. Write complete details to Box OT-7, c/o Industrial Refrigeration.

FOR SALE
2—10″x10″ 2 cyl. Frick D.C. to 100 hp motor.
2—10″x10″ 2 cyl. York D.C. to 100 hp motor
3—9″x9″ 2 cyl. York D.C. to 75 hp motor.
1—8″x8″ 2 cyl. Frick D.C. to 75 hp motor
1—7¾″x5″ Frick booster.
2—50 ton G.E. Freon condensing units.
1—50 ton Buffalo Freon evap. condenser.
1—6″x6″ Frick compressor.
1—5″x5″ York compressor.
3—9¼x14″ 115 hp Wolverine Diesel engines.
11x22x47″ and 11x22x51″ ice cans.
Ice plant — 20 to 160 tons.
ENTERPRISE EQUIPMENT CORPORATION
77 Alexander St. Yonkers, N. Y.
Cable ENEQCO Phone: Yonkers 8-8118-9

FOR SALE—4x4, 5x5, 8x8 Fricks. 5x5, 8x8 Yorks. 15 ton shell & tube condenser. 7½ and 9x9 York crank shafts. Write E. Niebling, 1546 St. Clair, Mt. Healthy, Cincinnati 31, Ohio.

FOR SALE—Two Bruce Macbeth 100 hp., gas engines with generators and exciters. If you have G4 model, spare parts would be valuable to you. Diamond Ice Co., Purcell, Okla.

FOR SALE—25 ton Frick ice plant nearly new; 8 can lift. Address Box OT-5, c/o Industrial Refrigeration.

FOR SALE
NEW EQUIPMENT — NEVER USED
310 ton York water chilling set-up complete with 300 hp. motor. Turbo compressor, speed increaser, chiller, condenser, controls, etc.

9x9 York with 75 hp. synchronous motor.
Two 7½x7½ Yorks with V-belt 50 hp.
Two 6x6 Yorks with V-belt drives 30 hp.
JOHN F. CARSON
A & Venango Sts. Philadelphia 34, Pa.
GArfield 6-22221

More Accurate Level Reading of LOW TEMPERATURE LIQUIDS . . .

JERGUSON

Large Chamber

NON-FROSTING* GAGES

YOU get the highest possible accuracy of reading on low temperature, low boiling point liquids with the patented Jerguson Non-Frosting Gage in the New Large Chamber model . . . because it insures less turbulence at the meniscus, and clear vision at the vision slot.

This new Jerguson model has 6 times large area at the meniscus than the standard gage, so that there is a marked reduction in turbulence with light gaseous fluids that tend to boil or surge. Moreover, the problem of frosting encountered with these liquids has been eliminated by a patented frost preventing unit extending from the gage glass. This special transparent unit projects beyond the cover bolts and prevents frost from building up over the vision slot.

Here's a dual feature gage that assures greatly increased accuracy of reading for the process industries. If you have a problem with light gaseous fluids, or with gage frosting, it will pay you to investigate the new Jerguson Large Chamber Non-Frosting Gage . . . reflex or transparent.

Jerguson Large Chamber Gage, Transparent Type, with the patented Non-Frosting Gage Glass Extension. Write for literature on this gage, and on other non-frosting Jerguson models.

**Patented*

JERGUSON

Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY
100 Foilsway, Somerville 45, Mass.
Offices in Major Cities
Jerguson Tress Gage & Valve Co., Ltd., London, Eng.
Pétrole Service, Paris, France

PIPE COILS

FABRICATIONS, Welded Headers or just single bends — whatever you need, our expert metalworkers can produce them to your exact specifications. Even in stainless steel, or up to 6 inch extra heavy. For quality work, backed by 37 years' specialization, call on us!

We'll gladly quote on your next job.

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Fiberglas Board holds temp at **45 BELOW** *in tropics!*

HAWAIIAN PINEAPPLE COMPANY, LIMITED, HONOLULU
Built on the second floor of an existing concrete building, the freezing tunnel and warehouse required a total of 109,347 sq. ft. of Fiberglas Board in various thicknesses.
Fiberglas Insulation installed by Craig & Co., Honolulu.

HAWAIIAN PINEAPPLE COMPANY
LIMITED
Honolulu 1, Hawaii, U.S.A.

January 26, 1954

Owens Corning Fiberglas Corp.
Pacific Coast Division
Santa Clara, California

Dear Sirs:

When this Company decided to enter the fresh frozen concentrated pineapple juice market, it became necessary to construct a commercial size freezing tunnel plus a low temperature refrigerated warehouses.

These were built on the second floor of an existing reinforced concrete building, the freezing tunnel requiring some 1800 square feet and the warehouse some 15,420 square feet of floor area. The desired temperatures were minus 45 degrees F. for the former and minus 10 degrees F. for the latter, with an outside ambient temperature of 85° F.

After careful study of various types of commercial insulating material, we selected Fiberglas for the walls and ceiling because of its special characteristics. These include an inorganic material which is durable and resilient combined with excellent heat insulation quality.

The total Fiberglas board used on this warehouse and tunnel job amounted to 31,923 square feet of 4-inch and 41,115 square feet of 3-inch board, all of 3¢ pound density. In addition we used 36,309 square feet of 2-inch board with 1¢ pound density as an inside liner.

These low temperature facilities have been in service for nearly four years and have proven to be satisfactory in every way.

May we take this opportunity to thank your organization for the many constructive suggestions which were made at the time the installation was being made.

Very truly yours,

R. H. Lloyd
Staff Engineer

Sharp freezing at minus 45 deg. F., while the outside ambient temperature is a tropical 85! Under those conditions, the insulation has to be nothing less than tops in thermal efficiency! Under those conditions, Fiberglas* Board has been "delivering the goods" for the past four years at the famous Hawaiian Pineapple Company plant in Honolulu.

Naturally the engineers carefully studied various types of commercial insulations before reaching a decision. They chose Fiberglas, according to Staff Engineer R. H. Lloyd, on the basis of its *inorganic structure, durability, resilience and excellent heat insulation quality.*

Four years of trouble-free service have proved their decision sound. Their experience, like many others in our files, suggests that anyone planning cold storage facilities should investigate Fiberglas Insulations *first!* If you'd like further information, just mail the coupon—today!

It's amazing the difference Fiberglas makes!

OWENS-CORNING
FIBERGLAS

*T-M. (Reg. U.S. Pat. Off.) O-C. F. Corp.

Owens-Corning Fiberglas Corporation,
Dept. 165-J, Toledo, Ohio

Please send me free the booklets I have checked:

- ☐ *Insulation for Low Temperature Structures and Equipment*
- ☐ *PF Design Details*
- ☐ *Why the Trend is to Fiberglas*

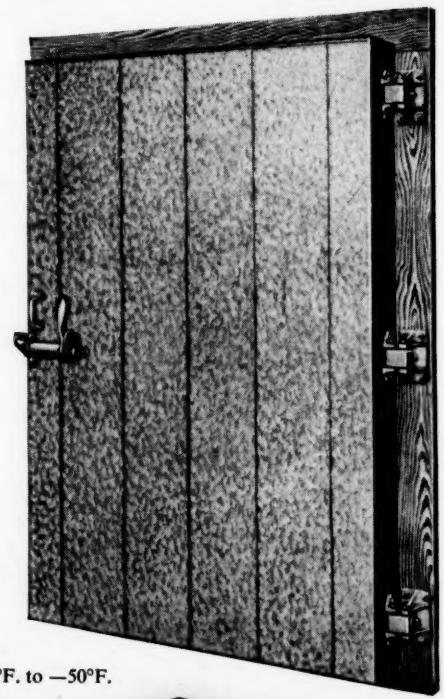
Name and Title _____

Company _____

Address _____

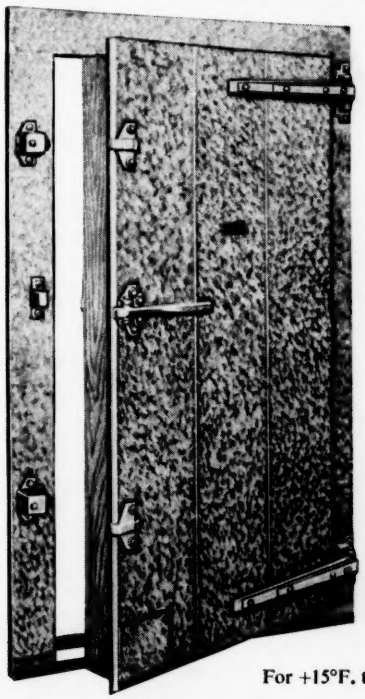
NEW Jamison VAP·R·TYT feature

...on all SUPER FREEZER DOORS



For 0°F. to —50°F.

...on all LO-TEMP DOORS



For +15°F. to —20°F.

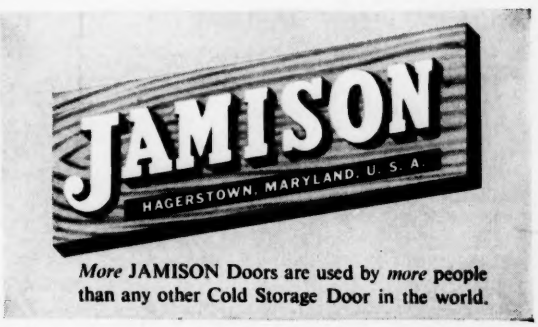
VAP·R·TYT* offers full protection against moisture penetration

**Vap-r-tyt is a Jamison trademark*

Soldered Seams. All seams are locked and then soldered to prevent moisture under high vapor pressure from penetrating into the core of the door.

Vap-r-tyt . . . the application of metal with locked and soldered seams with all penetrating bolts sealed, is an exclusive Jamison feature. Vap-r-tyt adds longer life to cold storage doors by guarding against deterioration which invariably results when moisture condenses on the inside of the door. Jamison Super Freezer and Lo-Temp Cold Storage Doors are now being furnished with Vap-r-tyt as standard equipment.

For further information on Vap-r-tyt write to Jamison Cold Storage Door Co., Hagerstown, Md.



More JAMISON Doors are used by *more* people than any other Cold Storage Door in the world.